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Power Engineering

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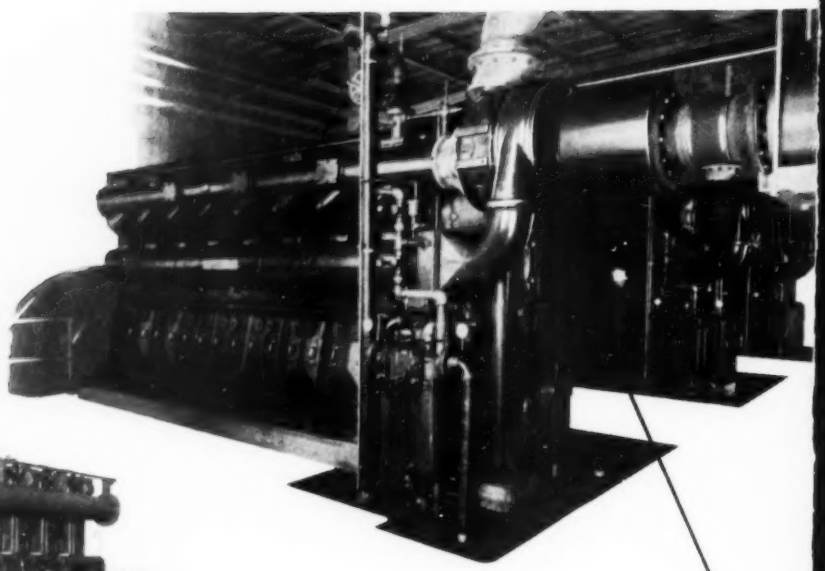
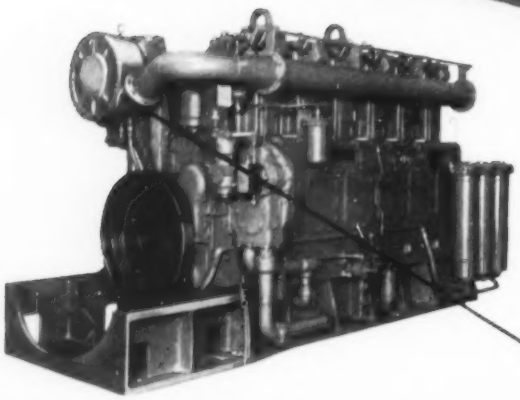
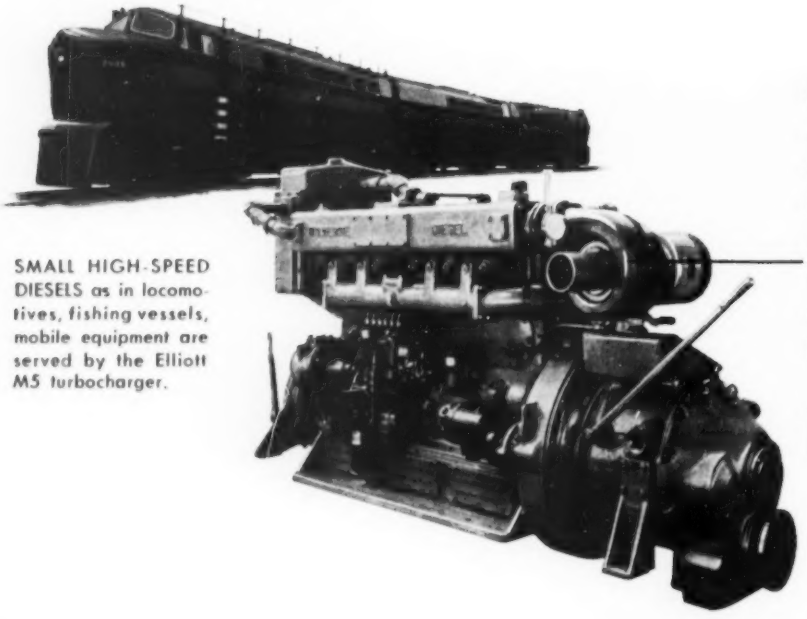




MANY COMMUNITY POWER PLANTS AND INDUSTRIAL POWER PLANTS get the ultimate in diesel performance with Elliott turbochargers.

In diesel supercharging,



SMALL HIGH-SPEED DIESELS as in locomotives, fishing vessels, mobile equipment are served by the Elliott M5 turbocharger.

SOME ADVANTAGES

- Improved efficiencies
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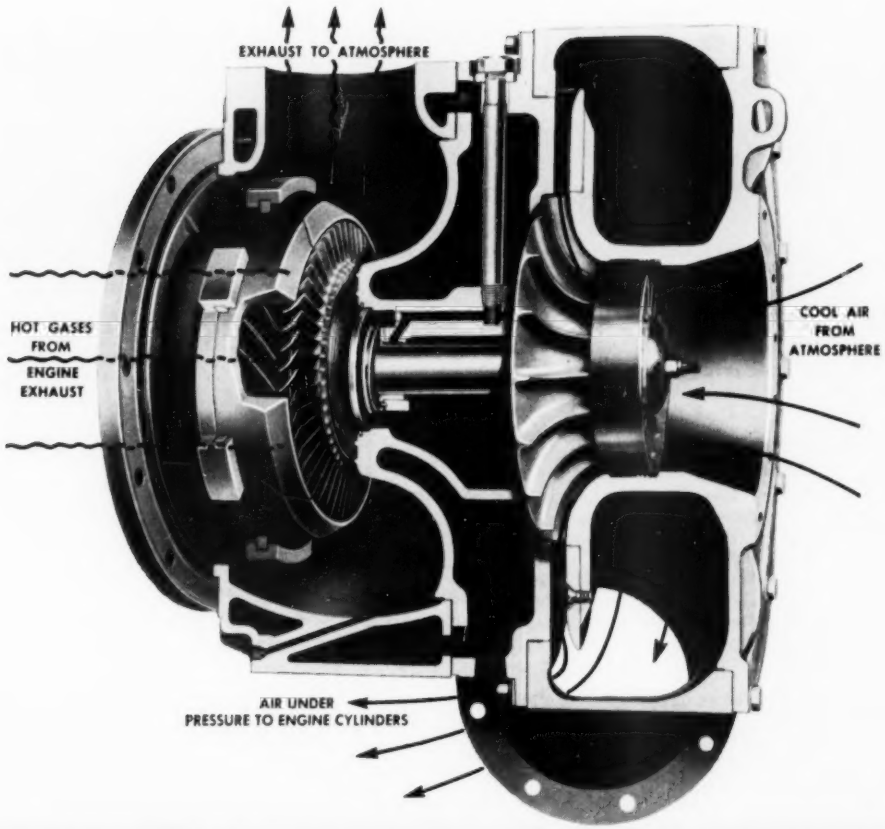
- More air flow
- Lower weight/horsepower ratios
- Lower specific fuel rates
- Less lube oil consumption
- Greater capacity to handle overloads
- Better scavenging
- Improved thermal efficiencies

M4.6



play safe with ELLIOTT

Elliott high-pressure turbocharger from air compressor end.

ELLIOTT TURBOCHARGERS in their design have long passed the stage of experimentation, and reached that of stabilized solutions in the many critical problems involved. This is the result of 14 years of Elliott experience in building and installing turbochargers on four-cycle diesels and more recently, on two-cycle engines as well. During this time over 10,000,000 hp of diesel engines has been turbocharged by Elliott.

Operated by the otherwise wasted energy of engine exhaust gases, Elliott turbochargers supply every function and advantage of supercharging without taking toll of engine power. Their application is an important economy in every way, and their performance is assured by the authoritative engineering experience back of them.

For complete data contact your local Elliott field engineer, or write Elliott Company, Supercharger Dept., Jeannette, Pa.

ELLIOTT Company

TURBINE-GENERATORS TURBINES MOTORS GENERATORS DEAERATING HEATERS EJECTORS CONDENSERS COMPRESSORS TURBOCHARGERS TUBE CLEANERS STRAINERS

For more data circle 501 on Post Card

Assembly Line Steam Trap Maintenance Saves Time and Money

It costs less to repair a group of traps before they all need it than to wait and repair one at a time

CHART I — COST OF LABOR FOR ONE TRAP

(assuming labor at $2.00 per hr.)

LABOR	MINUTES	COST
Get parts from store room	3	
Get tools	2	
From store room to trap	5	
Shut off steam	1	
Wait for trap to cool	5	
Remove cap and mechanism	2	
Replace Valve, Seat and Lever Assembly	4.5	
Remove old gasket and clean gasket surface	2	
Apply gasket dope	1	
Put on new gasket	1	
Install cap with mechanism	2	
Turn on steam	1	
Back to shop	5	
TOTAL PER TRAP	34.5 min.	$1.15
TOTAL COST OF LABOR FOR 8 TRAPS SERVICED INDIVIDUALLY	4 hr. 36 min.	$9.20

CHART II — COST OF LABOR FOR 8 TRAPS SERVICED AT ONE TIME

(assuming labor at $2.00 per hr.)

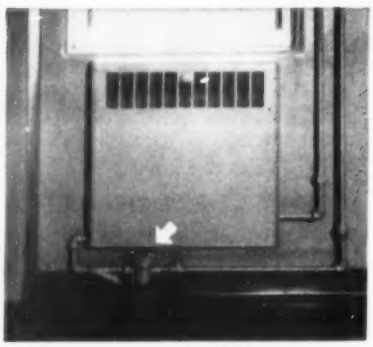
LABOR	MINUTES	COST
Get parts from storeroom	3	
Get tools	2	
From storeroom to trap	5	
Shut off steam	1	
Wait for traps to cool	5	
Remove caps and mechanisms	16	
Replace Valves, Seats and Lever Assemblies	36	
Remove old gaskets and clean gasket surfaces	16	
Apply gasket dope	8	
Put on new gaskets	8	
Install caps and mechanisms	16	
Turn on steam	1	
Back to shop	5	
TOTAL	2 hr. 6 min.	$4.20

ARMSTRONG traps do not demand constant attention, but when they do need repairs, maintenance money can be saved by replacing parts not only in the trap requiring immediate attention, but also, in the remaining traps of that series.

For example, assume eight traps were installed on an eight-coil dryer at the time of its installation. When one of these traps becomes worn to the point of needing replacement parts, there is a direct savings if *all* the traps receive new internal mechanisms at the same time.

Several traps draining the same machine, receive approximately the same wear. When one trap becomes worn to the extent of needing new internal parts the others will be soon to follow.

If the remaining traps have an average of 10% service life, before requiring repair, and the cost of a new valve, seat and lever assembly were approximately $4.00, replacement before absolutely necessary would involve a loss of $0.40 per trap. However, the labor cost involved will more than make up for this loss.



Armstrong No. 800 draining a convector at Globe Steel Tubes Company. Parts for this trap cost only 2¼ cents per year. Average trap life is 11 years.

Chart I shows that the cost of labor involved to service one trap is $1.15. Therefore, repair labor for eight traps serviced individually would cost approximately $9.20.

Chart II shows the cost of labor involved to service all eight traps at the same time. Here we find the labor cost is only $4.20. This leaves a labor profit of $5.00.

The loss of $0.40 per trap times the remaining seven traps is $2.80. Subtracting $2.80 from $5.00 leaves a profit of $2.20 gained by servicing all eight traps at the same time.

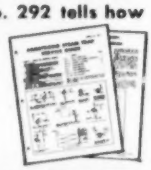
Thus, if traps are put on regular maintenance schedule and assembly-line servicing is employed, a very definite profit can be shown, plus the assurance of maximum operating economy at all times. Traps are kept in tip-top shape, eliminating steam or fuel waste that might occur if the trap is not caught before it goes bad.

Your local Armstrong Representative has parts in stock and valuable trap service knowledge to help you. Call him, or write:

ARMSTRONG MACHINE WORKS
810 Maple Street • Three Rivers, Michigan

FREE MAINTENANCE BULLETINS—

Bulletin No. 239 is an 8-page trap Service Guide; Bulletin No. 292 tells how to save money on trap repairs. Send for them — no obligation.



ARMSTRONG STEAM TRAPS

For more data circle 502 on Post Card

ENGINEERS' PREVIEW

FOR TWO or three years now, you have been reading in POWER ENGINEERING and other magazines in this field how the electrical demands of the country are increasing at a tremendous rate — in fact they're doubling every ten years and show no signs of falling off. Just in case you want a particular statistic to illustrate what is happening, the Commonwealth Edison system, serving the Chicago area, had a record peak load of 3,149,000-kw in 1953. That is enough electricity, according to the end-to-end experts, to light 31,490,000 lamps of 100 watts each. To meet the demand on the peak day, the eleven stations of the system burned 35,265 tons of coal. The 1953 peak load represented 96 per cent of the capacity of the Commonwealth Edison system and occurred from 5:30 to 6:00 P.M. on Wednesday, December 23. The normal regular heavy winter demand was undoubtedly augmented by a record amount of Christmas tree and decorative lighting and it is estimated that this special lighting added approximately 100,000 kw to the regular load.

* * *

CLEVELAND Electric Illuminating Co. has been cited for the Charles A. Coffin Award, highest distinction in the electric industry, it was reported by the Edison Electric Institute.

Its second such honor in the last three years, the company was cited "for its application of modern and progressive management principles and techniques in meeting problems of growing complexity arising from rapid expansion and increasing costs; in effecting reduced costs of managing and operating the business; and in broadening executive participation in civic and community activities."

The Coffin Award was established 32 years ago by the Charles A. Coffin Foundation, in honor of the first president of General Electric Co. Presentation of the final award was made at special ceremonies during the Edison Electric Institute's 22nd annual convention, held in Atlantic City in June.

* * *

FOUR generating units, each of 150,000 kw, now are operating at TVA's Shawnee Steam Plant near Paducah. The fourth unit went into commercial operation recently. Six more units remain to be completed. Shawnee is being built to furnish power to new atomic energy plants.

The units now completed represent the plant originally designed by TVA to meet half of the initial power requirements for AEC at Paducah. Meanwhile TVA was called upon to more than double the original supply, providing more than 1,200,000 kw.

Construction of the Shawnee plant is being accomplished within TVA estimates, it is stated. The cost per kilowatt of capability for the completed plant is estimated at $145.

A private company, Electric Energy, Inc., will furnish AEC approximately 735,000 kw from its plant now under construction at Joppa, Ill. Two of this plant's planned six units now are operating.

* * *

IT TAKES something special in the form of a starter to get the big Pratt & Whitney J57 jet engine into operation. Eight of these engines provide the Boeing B-52 Stratofortress with more than 80,000 hp. The engine cannot be started in the usual manner with an electric starter or a cartridge. It calls for a terrific blast of compressed air to be directed at an air turbine starter motor, which in turn spins the J57 fast enough to sustain combustion. The Boeing 502 gas turbine has been found capable of providing this blast. The gas tur-

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PUBLISHED SINCE 1896 FOR POWER ENGINEERS IN PRIVATE AND PUBLIC UTILITIES AND INDUSTRIAL PLANTS

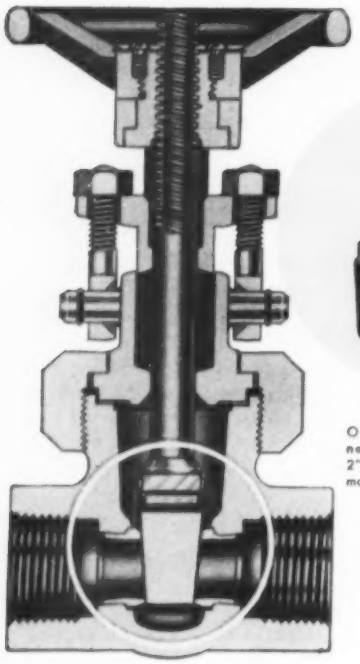

FIG. 1221
O S & Y, union bonnet. Sizes: ¼" to 2". 600 pound primary pressure series.

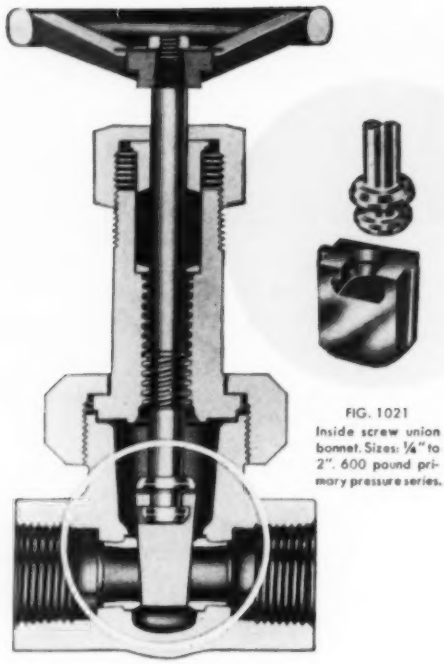

FIG. 1021
Inside screw union bonnet. Sizes: ¼" to 2". 600 pound primary pressure series.

New design makes OIC forged steel gate valves the most modern line . . .

NEW: stronger stem-to-wedge connection. Improved, modern design increases pull-out strength to many times the theoretical requirement. This design distributes the pull-out load more efficiently throughout the wedge structure to meet the most stringent specifications of valve buyers in all fields.

NEW: wedges wear longer. Wedges are made of 13% chrome stainless steel for corrosion resistance. They are duracased to at least 1000 Brinell Hardness to prevent galling and excessive wear caused by frequent closures upon foreign particles in the flow.

NEW: union bonnet design is more efficient. Body-to-bonnet joint of the male-female type provides a recess for the gasket. It is contained more securely, reducing the possibility of leakage or a blown gasket.

OTHER OUTSTANDING FEATURES

Stem threads of all OIC inside screw, forged steel valves are always contained inside the bonnet. They can't possibly load up with corrosive matter which might be in the flow. This keeps the threads clean and free running, and contributes to longer stem wear.

Modern OIC Seal-Ever packing is a special composition which eliminates electrolytic action between the stem and the packing. This prevents stem corrosion in the packing area and helps maintain a leakproof seal.

Back-seating feature provides means of repacking valves while in service.

OS & Y valve gland "I" bolts are retained on trunnions by modern, more efficient, stainless steel snap rings.

Shoulder-type seat rings are expanded into the body under heavy pressure. They are accurately machined to mate tightly with the wedge for a positive seal.

Order modern OIC Forged Steel Valves from your nearby OIC Distributor. Write and request Folder No. 195.

OIC Forged Steel Valves are also available in globes, angles and checks in a variety of trims for any service.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

OIC
FOUNDED 1893
VALVES

FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON

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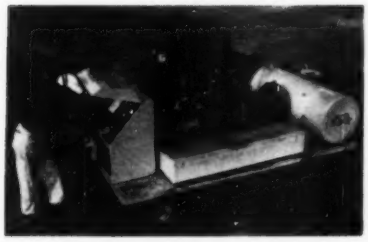


One of Boeing's "502" gas turbines providing 140 air hp, adapted as starter for 157 engine on B-52 Stratofortress

bine unit, complete with two engines, two compressors, fuel tanks, batteries, starting systems and instrument panels, is all mounted on a dolly, as shown in the accompanying illustration. It puts out 280 air hp as compared with the 57 hp provided by a commercial predecessor.

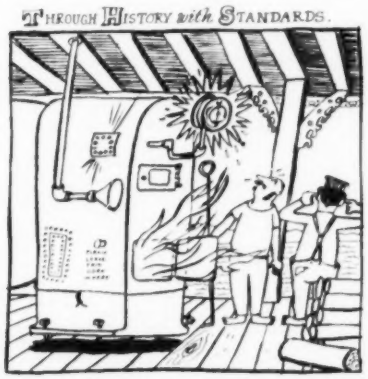
* * *

THE NEWCOMEN MEDAL, given only three times before in the history of the U. S. branch of The Newcomen Society, was recently awarded to William H. Rowand, vice president of Babcock & Wilcox Co. The medal was awarded primarily for Mr. Rowand's contributions to steam progress, foremost among which was his invention in 1946 of the cyclone steam separator. He was also active in subsequent development of higher-temperature and higher-pressure boilers.

* * *

STANDARDS are a complex and serious matter. Only once in a blue moon do we have an opportunity to present the story of standards in a light vein, using cartoons to provide humor. This has been done very skillfully in a booklet entitled Through History With Standards published by American Standards Association, Inc., 70 E. 45th St., New York 17, N. Y.

Reproduced here is a typical example of the illustrations used. This one accompanies a discussion on how a standard for steam boilers brought new safety to an old hazard. This part of the booklet describes the work done in developing the present-day ASME Boiler Code.



Caption for this drawing in standards book: "It shall be a vexation only to understand the report: — Isaiah, XXVIII."

F. W. ARGUE has been named engineering manager of Stone & Webster Engineering Corp. with headquarters in Boston. He will be in charge of engineering and design activities. He joined the company in 1941 and was named assistant engineering manager in November, 1952. W. F. Ryan, vice president, has been named the firm's senior consulting engineer.

LETTERS TO THE EDITORS

The Separate Loop at 270-250 F

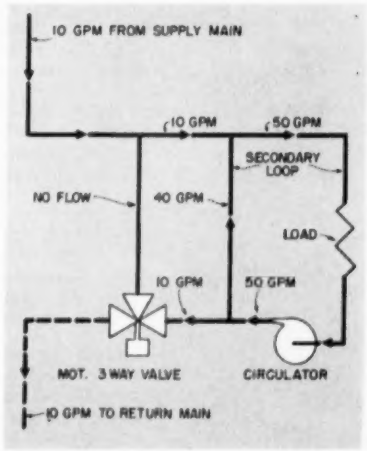
THE ARTICLE entitled "High Temperature Water Heats Twenty-Nine Palms Marine Base" on page 84 of your March issue is very interesting. I wonder if you could transmit to the author a question regarding the flow diagram on page 85.

Opposite this diagram, the article states that "by means of a separate loop at 270 250 F. serves the hot water coil or coils installed as a part of the heating and cooling system." Now the diagram shows this to be all one circuit from the boiler to the heating system. Apparently, there is something missing in the diagram and I am curious enough to bring this matter to the author's attention through your very kind action — *C. E. Bronson, Kewanee, Ill.*

Editor's Note: — Mr. Bronson's letter was forwarded to J. P. Harrington of Harrington & Bradford, consulting engineers, Los Angeles, Calif. and here is his reply:

YOUR LETTER to POWER ENGINEERING relative to our article on high-temperature water has been forwarded to this office with the request that we answer your question regarding the "separate loop at 270–250 F."

The enclosed enlargement of that portion of the flow diagram in question will tend to clarify the operating features of the secondary loop. For example, if the load to be served at 270–250 F water was required, the flow conditions in and at the secondary loop would be as noted on the sketch. For this maximum load, the three-way valve would be closed against the supply, open full on the return, and the full 10 gpm would be entering the secondary loop and the equivalent amount of 250 F would be leaving the secondary loop to the



return main. (*See diagram above*).

Under conditions of reduced load, the three-way valve would open toward the supply and be restricted against the return. Only that quantity of high-temperature water required to meet the new load conditions would enter the secondary loop, the remainder would be by-passed through the three-way valve to the return main.

It is evident, we are sure, that if the main distribution system is designed for a temperature of 100 F differential and the equipment serving the load is selected on a 20 F temperature differential, then the circulation rate within the secondary loop must be approximately five times greater than the maximum high-temperature requirements of the building.

Your interest in the article is gratifying and we are glad that POWER ENGINEERING afforded us the opportunity of clarifying a feature of this type of installation which was of necessity somewhat clouded by the omission of specific examples and details. — *J. P. Harrington*

HERE'S WHAT THEY TELL US

HAROLD DURGIN, recently elected as a fellow of The American Institute of Electrical Engineers, sent this note to Executive Editor **Chester Earle:**

> "I don't remember just where our gas turbine plant stood when you last visited us (*Central Vermont Public Service Corp.*), but I expect since you were here we have put in another unit. As I recall it, we had one unit running and another being assembled. During the past fall and as a matter of fact, up until a couple of weeks ago we had all three units running. At the moment, No. 3 unit is being dismantled for some mechanical changes which have already been made to units 1 and 2. We are now operating regularly on No. 6 oil, and it appears that the problem of successfully burning this oil in the gas turbines has been solved."

Walter N. Handy, Walter N. Handy Company, Inc., requested copies of the article on fly ash (Apr. '54, p. 70), along with this comment:

> "For your information we are marketing the fly ash produced by the utilities at Milwaukee, Kansas City, St. Louis, Louisville, and Corn Products Company at Argo, Ill."

A few days later, when Mr. Handy was in our office, he gave us these interesting facts: (1) his company is now supplying a substantial tonnage of fly ash for oil-well cements; (2) the ICC has issued an order that a rate of 9½ per cent of Docket 28,300 shall be made effective prior to July 22 for fly ash which in some freight territories will mean a freight reduction on fly ash of about 50 per cent — in others, it may be only 10 per cent.

The above should be viewed conservatively by those prepared to do a good engineering job of marketing fly ash . . . *it takes more than fly ash to go into the fly ash business.* Some people have gotten into trouble with it, and the principal reason was lack of sound engineering. Too much of this could give a promising infant industry a black eye when its recuperative powers are at the lowest point.

Incidentally, ASME advises us that their supply of papers Nos. 49-A-79, 49-A-81, 49-A-82 and *49-A-83 is exhausted and that any further requests must be filled by photostating at their regular page rates.*

L. Greif, Jones & Brakeley, queried:

> "I noticed that POWER ENGINEERING has invented a new metallic insulation, magnesium to be exact. Does it really work? But quite seriously, if it had not been for two years of writing about this fluffy material, I probably never would have noticed this typo in the March issue, Fig. 4, p. 74. I am sure you meant magnesia rather than magnesium."

All of a sudden we became aware of our invention of a new metallic insulation and have already administered 40 lashes to the proofreader for so inventing it. *We did mean magnesia.*

The 35th year in the field of electrical operation for **F. E. Burkheimer,** city electrician in Winthrop, Minn., brought us an enthusiastic note:

> "I like the new products material features, also the electrical engineering problems as presented in POWER ENGINEERING each month. Personally, I like to review problems in electrical distribution, 3-phase delta and 4 wire wye voltage and metering.
>
> "I have just completed installation of 3 single phase 50 kva voltage regulators for our present voltage of 2400 v. Later this summer we will cutover to 4160 Y voltage."

Others interested in reviewing problems in electrical distribution may want to check that authoritative volume — Croft's American Electricians Handbook. It covers many of the basic aspects of low voltage electrical distribution.

"Hang on to that — that's evidence!"

In concise manner, **Frank Westinicky,** Chicago, said:

> "Looking through your POWER ENGINEERING magazine, I saw an article I should like to have — Zone Heating. My partner would tear my head off if I tore up the magazine, so please send me the tear sheets."

Pronto we sent Steam Alone Powers New System Using Unit Heaters — Feb. '54, p. 77. We wanted no tearing apart of magazine *or* head.

It was also a pleasure to send tear sheets of Automatic Hard Facing of Worn Pulverizer Parts Pays Off, to Señor **Andres Zauschevich,** Administrador, Fundicion Nacional de Paipote Ltda, Copiapo, Chile, South America. The request was made by **John Drabelle** currently sojourning in Florida.

Señor Z. has some Raymond mills and we trust this will be helpful information. Our executive editor spent several hours watching the machine work down in the Lake Shore Station at Cleveland, and he can certify that it produces exactly the result shown in the photographs and works just the way author Ruggie described it in the April issue. The Cleveland people rigged up the whole procedure themselves.

It looks to us like the sort of thing that anybody with the roller-type mills should look into in order to save time and money in maintenance.

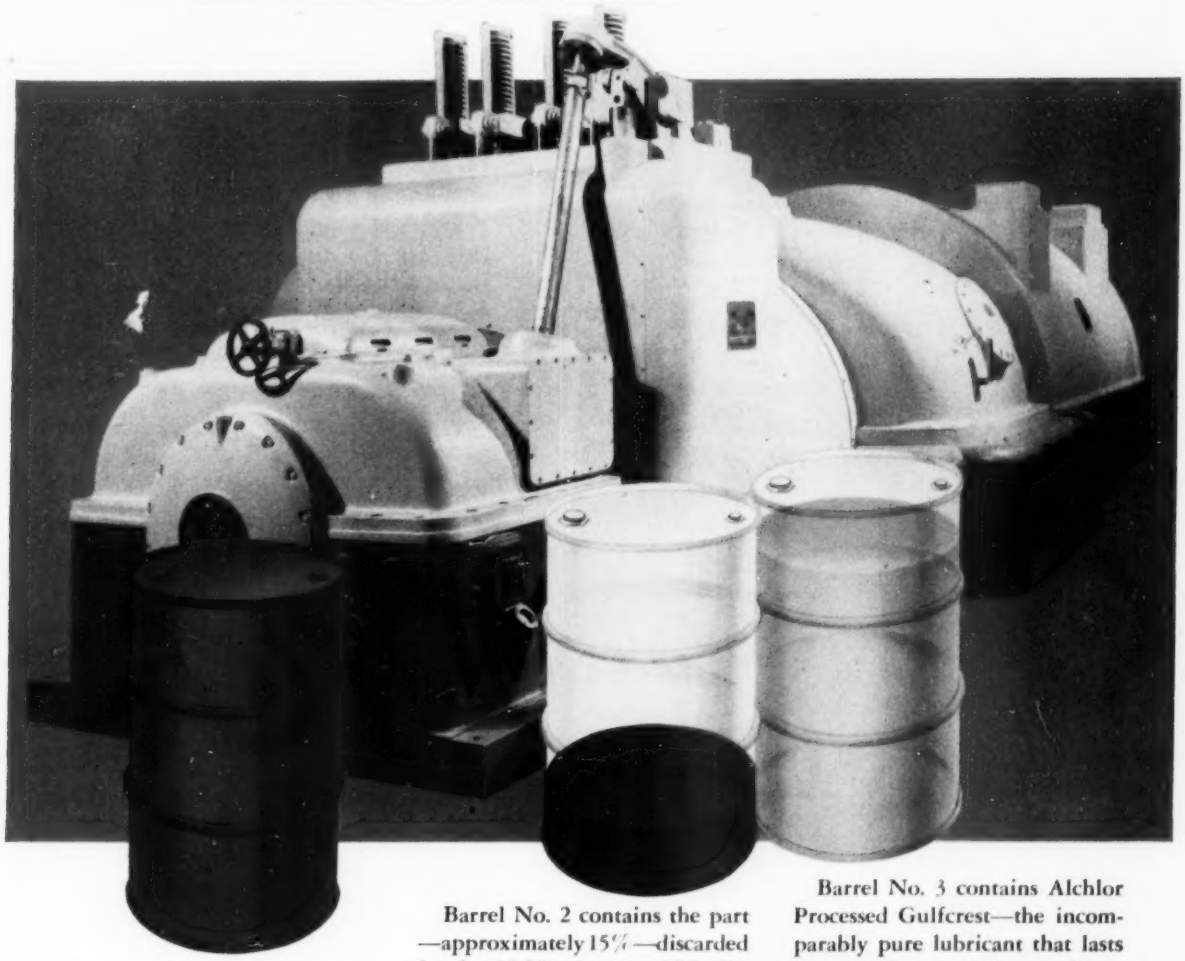
To far-away China we sent a copy of the colored poster of an Atomic Power Plant. It went to Engineer **C. W. Chang,** Hsinying Pulp Mill, Taiwan Pulp & Paper Corp., Tainan City, Taiwan (Formosa).

G. L. Master, mechanical engineer for Metropolitan Edison Company, tells us how he will use his copy:

> "As a public relations function we have been conducting guided tours of organized groups through our newest generating station. In explaining the future of our industry, atomic power may be discussed, and a poster such as you offer, may help to show how the atom will be put to work producing power for us."

We are heartily in favor of Master's idea to publicize future applications of the atom, and hope that he will call on the editor of POWER ENGINEERING for any assistance he may need. Editor **Andrew Kramer** for a long time has been a specialist in the peaceful use of the atom. He is a member of the AEC Advisory Committee, spends about half of his time with other members of the committee at AEC facilities, and prepared the text in the recent publication "Nuclear Power Reactor Technology." This government publication gives him credit for this, a rare circumstance and a point which is easily overlooked by the casual reader. In his spare time Andy edits ATOMICS.

GULFCREST *is the only turbine oil that is super refined for superior performance by the ALCHLOR PROCESS*



Barrel No. 1 contains a highly refined oil that will become Gulfcrest. It has gone through the usual steps used in refining other turbine oils—but has not yet been Alchlor Processed.

Barrel No. 2 contains the part —approximately 15%—discarded by the Alchlor Process. This discarded portion contains unstable hydrocarbons which, if allowed to remain in a turbine oil, are likely to oxidize, increase neutralization number, form sludge, emulsifiers, and harmful acids.

Barrel No. 3 contains Alchlor Processed Gulfcrest—the incomparably pure lubricant that lasts longer, gives superior performance and helps keep your turbine systems clean indefinitely. To make Gulfcrest even finer, special inhibitors are added to give it still greater stability and protect against corrosion and foam.

Call your nearest Gulf office today and have a Gulf Sales Engineer recommend the proper grade of Gulfcrest Oil to meet the specific requirements of your turbines.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION • GULF REFINING COMPANY • 1822 Gulf Building, Pittsburgh 30, Pa.

For more data circle 504 on Post Card

"this is

NEW! WIDER VISION!

Clear, brilliant readings from any angle, are possible with the new "wide vision" face on the Yarway Remote Liquid Level Indicator. Pointer is always visible, even at extreme high and low water levels.

The Yarway Indicator is manometric type with automatic temperature compensation, as approved for use under the ruling of A.S.M.E. Boiler Code Committee in Case #1155.

Described in Yarway Bulletin WG-1824.

● Engineers tell us Yarway Remote Liquid Level Indicators are the most dependable boiler insurance they can have.

Instant . . . accurate . . . brilliant . . . continuous readings of boiler water level are seen on the panel or wherever you wish in your plant. You know the readings are right because they are controlled by the boiler water itself . . . by the pressure differential between a constant head of water and the varying head in the boiler drum. *Indicating mechanism is never under pressure.*

Yarway Indicators may be equipped with a Yarway Control Unit that operates Remote Hi-Lo-Alarm signal lights or horns. For a 24-hour record of boiler water levels, use the Yarway Hi-Lo-Graph Recorder.

On the boiler drum itself you'll want Yarway Water Gages . . . and these "bright as a star" gage readings can now be televised with a Yarway—RCA Television chain.

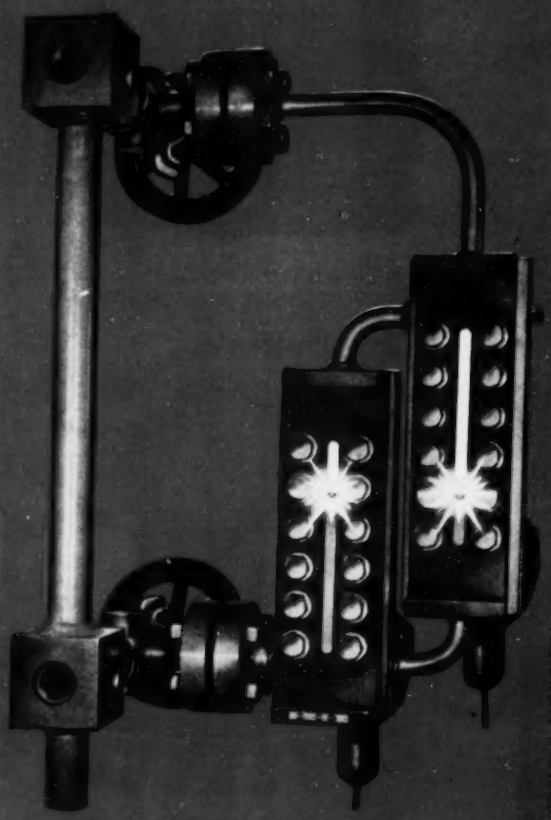
From drum to panel and at all remote locations, Yarway equipment gives you the safest boiler protection you can buy . . . proved beyond doubt in thousands of power plants.

Write for the specific bulletins you want.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY

good boiler insurance!"



YARWAY WATER GAGES

Flat glass, high pressure type shown, features new separated-design insert and Type "M" Illumination that causes water level meniscus to "shine like a star". Described in Yarway Bulletin WG-1812.

YARWAY REMOTE SIGNAL ALARMS

Lights on horns, operated by Control Unit on Yarway Indicator, give instant warning of any serious deviation from normal water level. Can be located anywhere in plant. Described in Yarway Bulletin WG-1824.

YARWAY MI-LO-GRAPH RECORDER

Gives a continuous 24-hour record of liquid levels. Actuating mechanism is same as in Yarway Indicator. Used both for indicating and recording. Described in Yarway Bulletin WG-1830.

YARWAY TELEVISION

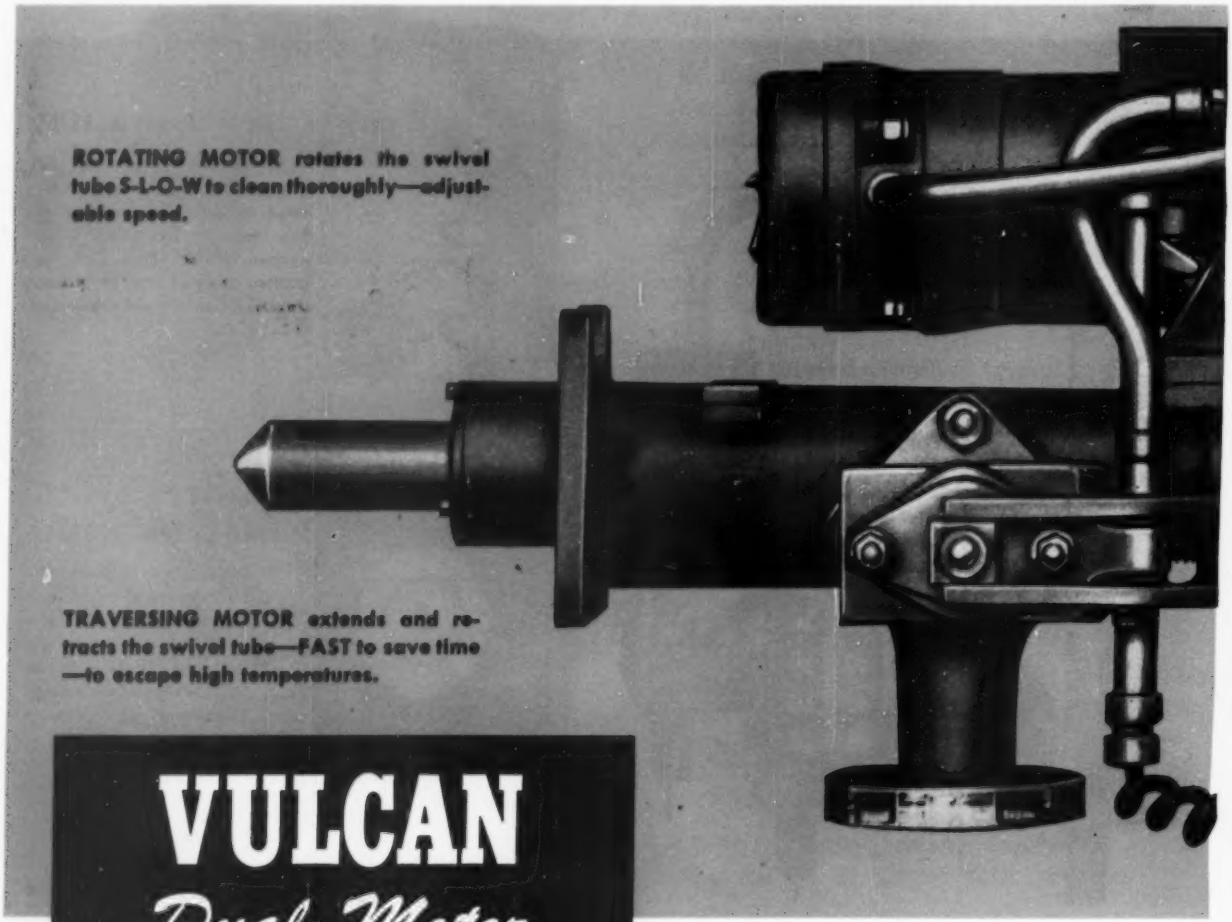
Simplified system consists of compact camera and panel-mounted monitor. Clear, bright image of water level gage anywhere in the plant.
Described in Yarway Bulletin WG-1813.

steam plant equipment

BLOW-OFF VALVES
WATER COLUMNS AND GAGES
LIQUID LEVEL INDICATORS
EXPANSION JOINTS
STEAM TRAPS
STRAINERS
SPRAY NOZZLES
DIGESTER VALVES

For more data circle 505 on Post Card

How to STOP


ROTATING MOTOR rotates the swivel tube S-L-O-W to clean thoroughly—adjustable speed.
TRAVERSING MOTOR extends and retracts the swivel tube—FAST to save time—to escape high temperatures.

VULCAN
Dual-Motor Wall Deslaggers

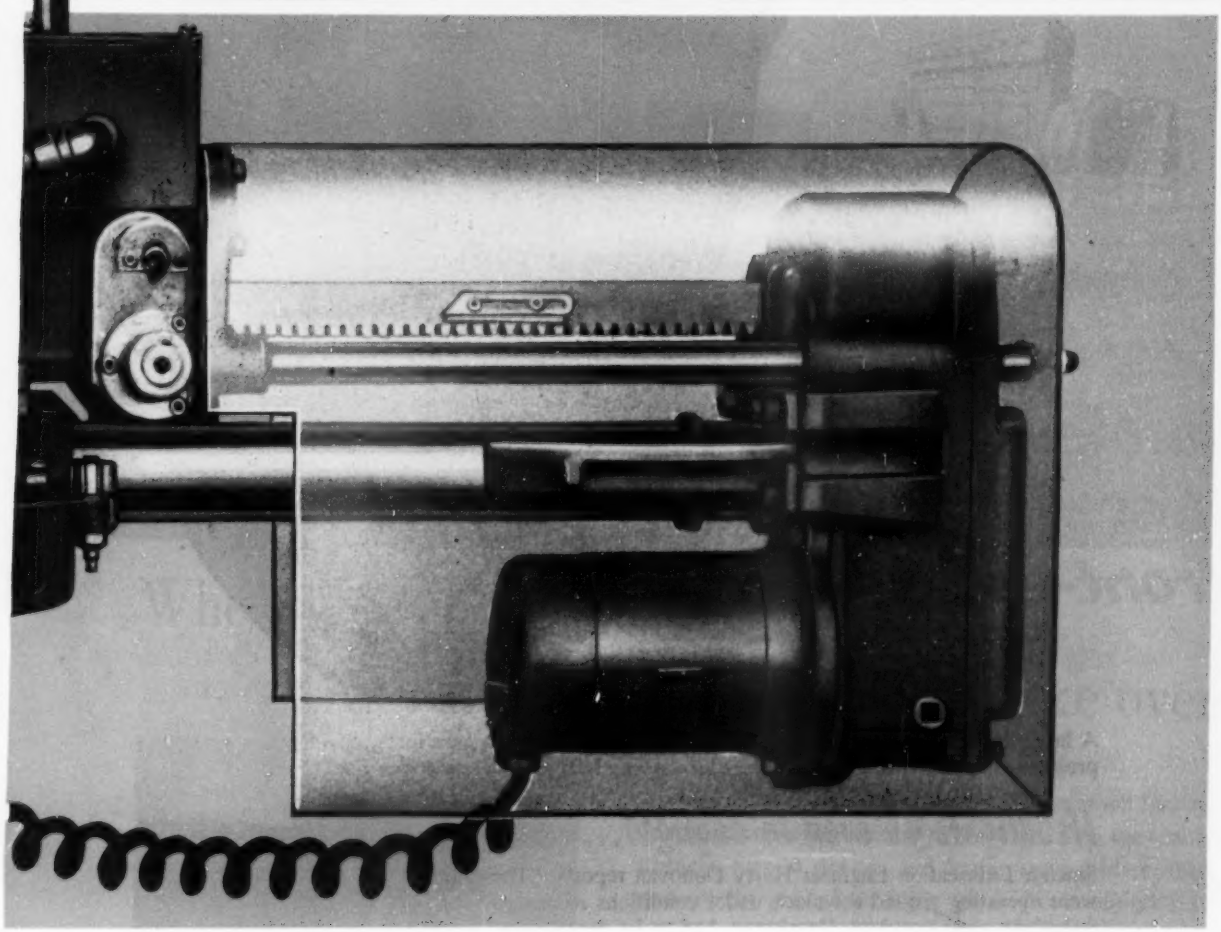
With direct-acting valve Clean BETTER and FASTER

KEEP slag and sintered dust from upsetting heat-transfer capacity and superheat or reheat control. Stop their build-up—quickly and effectively—with the high-power mass blowing and fast action of Vulcan Wall Deslaggers.

Thanks to dual-motor drive—electric or air, electric shown—a Vulcan Deslagger

VULCAN *Automatic*

SLAG BUILD-UP



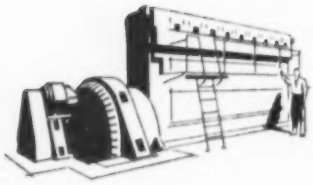
extends into the boiler, cleans and retracts from the high-temperature zone—all in 76 seconds. The cycle can be repeated often, if needed to control deposits.

Steam, air or water—or any combination of them—may be used as the blowing medium without change in equipment. The blowing or cleaning arc can be any angle up to a full 360 degrees.

The story is told in detail by new Bulletin 1016. Write for it.

COPES-VULCAN DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
ERIE 4, PENNSYLVANIA

For more data circle 506 on Post Card



"Cured... bearing failure in their diesel-driven, front-end loaders"

A large fire-brick manufacturing company in the Philadelphia area had the problem of premature bearing failure in its diesel-driven loaders and shovel.

Headlights on even in daylight...

Sinclair Lubrication Engineer Harry Donovan reports, "These units were operating around the clock under conditions *so dusty that headlights were required.* Crankcases had to be drained and flushed bi-weekly! My first recommendation was closer adherence to an air filter maintenance program."

Drain intervals doubled!

Mr. Donovan continues, "Further observation proved to me that excessive idling and overloading were all contributing factors to a severe sludge condition. I recommended Sinclair SUPER TENOL® – explaining that the superior quality of the base oil plus the Sinclair formulated additives would extend bearing life *while at the same time removing accumulated lacquer and sludge.* A trial period proved SUPER TENOL doubled drain intervals and eliminated flushing entirely. This company now uses Sinclair SUPER TENOL exclusively."

Why not give a Sinclair Lubrication Engineer the chance to solve *your* lubrication problems? *There's no obligation.* Contact your local Sinclair office or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR LUBRICANTS

For more data circle 507 on Post Card

When coal is carried to Narragansett, U. S. Rubber conveyor belts take over

This "U.S." belt carries coal at a rate of 1000 tons per hour at a speed of 615 feet per minute, to a crushing station.

When coal arrives at the docks of the Narragansett Electric Company, conveyor belts get to work and haul the coal to crushers, then to storage, and finally to the boilers which motivate the generators. Eight different belts are used, all made by United States Rubber Company. They do their job so steadily, economically and dependably that officials of the electric company have ordered additional "U.S." belting for further expansion.

"U. S." belting technicians are constantly coming up with new developments that pay off at a dollars-and-cents level for you. Familiarize yourself with the advantages of "U. S." Three-Way Engineering. Get in touch with any of the 26 "U. S." District Sales Offices, each staffed with engineers. "U. S." belting service is also obtainable from any of our selected distributors. Or write to address below.

"U. S." Research perfects it.
"U. S." Production builds it.
U. S. Industry depends on it.

US RUBBER

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting

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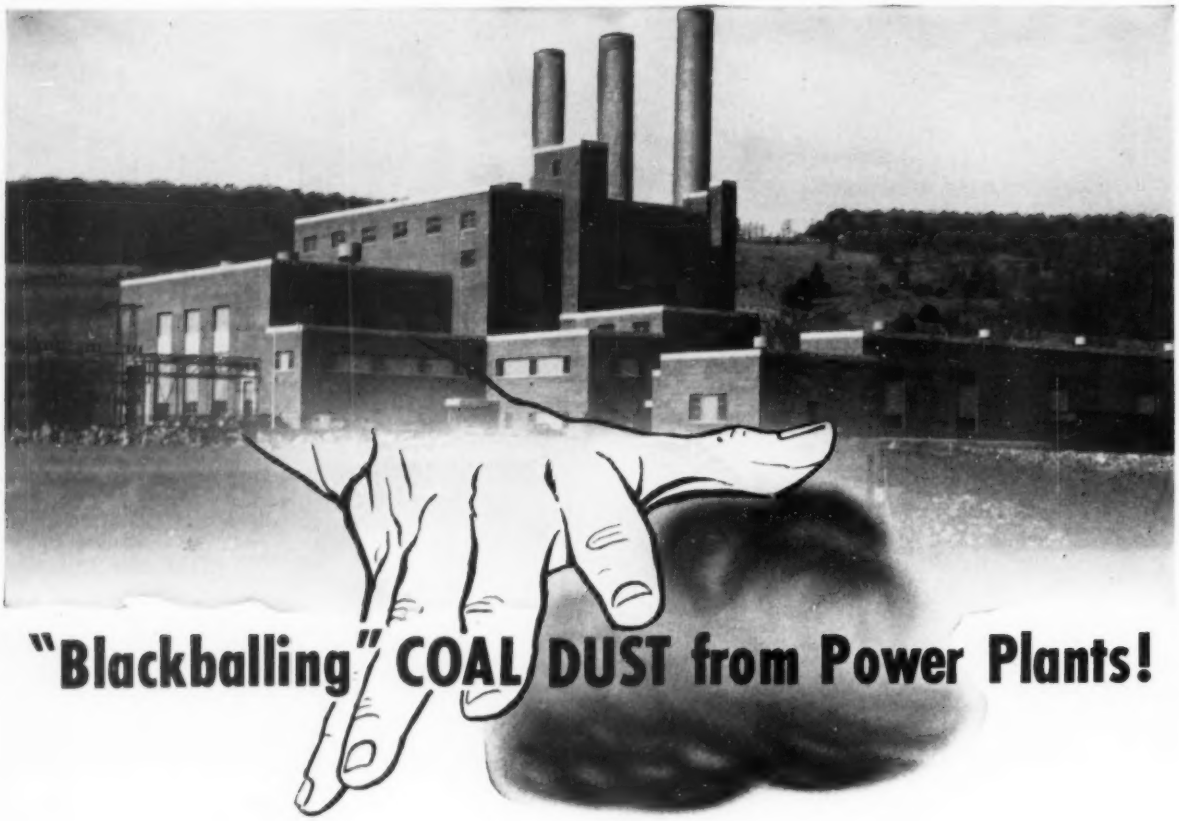

"Blackballing" COAL DUST from Power Plants!

THE CONTROL OF COAL DUST in power plants has been perfected by Johnson-March with engineered systems that stop coal dust at its source . . . wherever it occurs . . . before it can become airborne.

NO LONGER NEED COAL DUST BE . . .

- a maintenance problem
- a community nuisance
- a fire or explosion hazard

LOW-COST INSTALLATIONS at car dumpers, crushers, hoppers, belt galleries and coal piles are successfully eliminating coal dust in many leading power plants throughout the country. Similarly, fly ash handling and disposal need no longer be a dust problem. No costly ducts, hoods or fans to interfere with normal operations. First cost is 1/10 that of other systems and maintenance cost is next to nothing.

JOHNSON-MARCH ENGINEERED SYSTEMS are used in many plants to supplement and improve the effectiveness of existing mechanical dust collection systems. If you now have such a system, or if you have no control over coal dust, let Johnson-March engineers analyze your dust problems and recommend an economical "custom-made" system that will eliminate your plant and community dust nuisance. Write for full details.

Johnson March

Dust Control Engineering

DEPT. PE, 1724 CHESTNUT STREET, PHILADELPHIA 3, PA.

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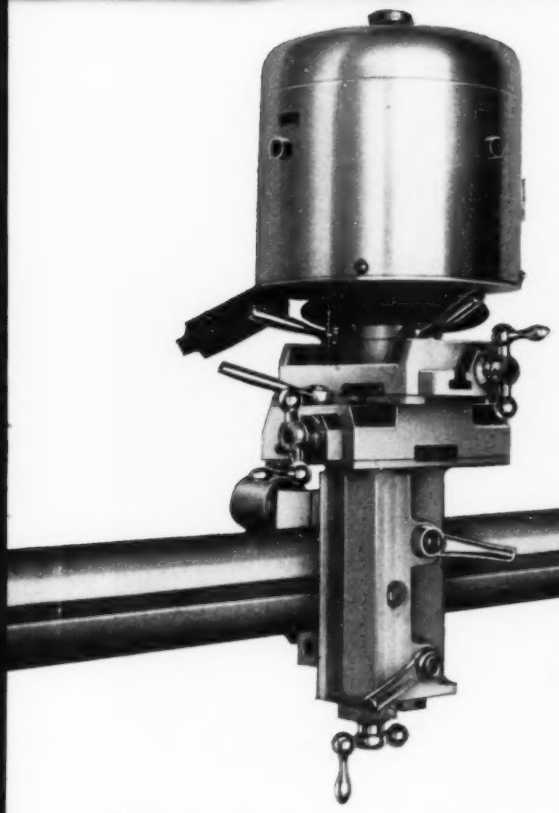

Consider the low cost of model testing

. . . when critical piping is the order!

Mechanical engineers are quite familiar with the fact that today's high operating temperatures may produce severe expansion stresses and reactions in high temperature power piping systems. But the accurate determination of these by analytical methods can involve extremely complicated and tedious mathematics.

A proved means for eliminating much of the expense of this essential engineering is the Kellogg Model Tester. This device's patented electrical measuring heads (illustrated), together with its servo-operated electronic equipment, enable Kellogg engineers to make complete analyses of thermal effects including line movements . . . at low cost.

For very complicated piping systems, the model tester is the only practical method of obtaining accurate solutions. For simpler systems, it serves as a relatively inexpensive check on calculated results. Furthermore, once the permissible reactions are established for loadings at the throttle valve and the superheater header connections, the optimum design for the remainder of the system can be developed without removing the model from the tester. For analyses of less complicated piping systems, Kellogg engineers employ a modern IBM computer to reduce costs and time required to arrive at results.

Well-conceived support and anchor designs for the suspension and expansion control of all classes of lines are readily established from the information furnished by the model tester. It can also provide data to insure proper handling of the piping in the field, during welding and heat treating . . . minimizing strains, due to extraneous loadings, which might be detrimental to the production of soundly welded joints.

This approach to the problems of critical power piping—the development of new and improved methods, of less expensive methods—is Kellogg's basic stock in trade. Many power station designers and utility companies also say it's the basic reason why they repeatedly specify *"critical power piping by Kellogg."*

* * * *

NEW POWER PIPING BOOKLET . . . Send for descriptive literature about Kellogg's extensive facilities for assuring the highest quality workmanship.

These leading companies are among the many major producers of power who use M. W. KELLOGG POWER PIPING . . .

- Hartford Electric Co.
- Houillers Du Lorraine (France)
- Houilleres Du Bassin Du Nord Et Du Pas-De-Calais (France)
- Hydro-Electric Power Commission of Ontario (Canada)
- Indiana & Michigan Electric Co.
- Long Island Lighting Co.

OTHER FABRICATED PRODUCTS **include:** Pressure Vessels . . . Vacuum Vessels . . . Fractionating Columns . . . Drums and Shells . . . Heat Exchangers . . . Process Piping . . . Bends and Headers . . . Forged and Welded Fittings

For further information, details of methods, etc. contact:

FABRICATED PRODUCTS DIVISION
THE M. W. KELLOGG COMPANY

225 Broadway, N. Y. 7, N. Y.
also Jersey City, Buffalo, Birmingham, Chicago, Los Angeles, Tulsa, Houston . . .
In Canada—Toronto and Edmonton
In Europe—London and Paris

KELLOGG — A SUBSIDIARY OF PULLMAN INCORPORATED

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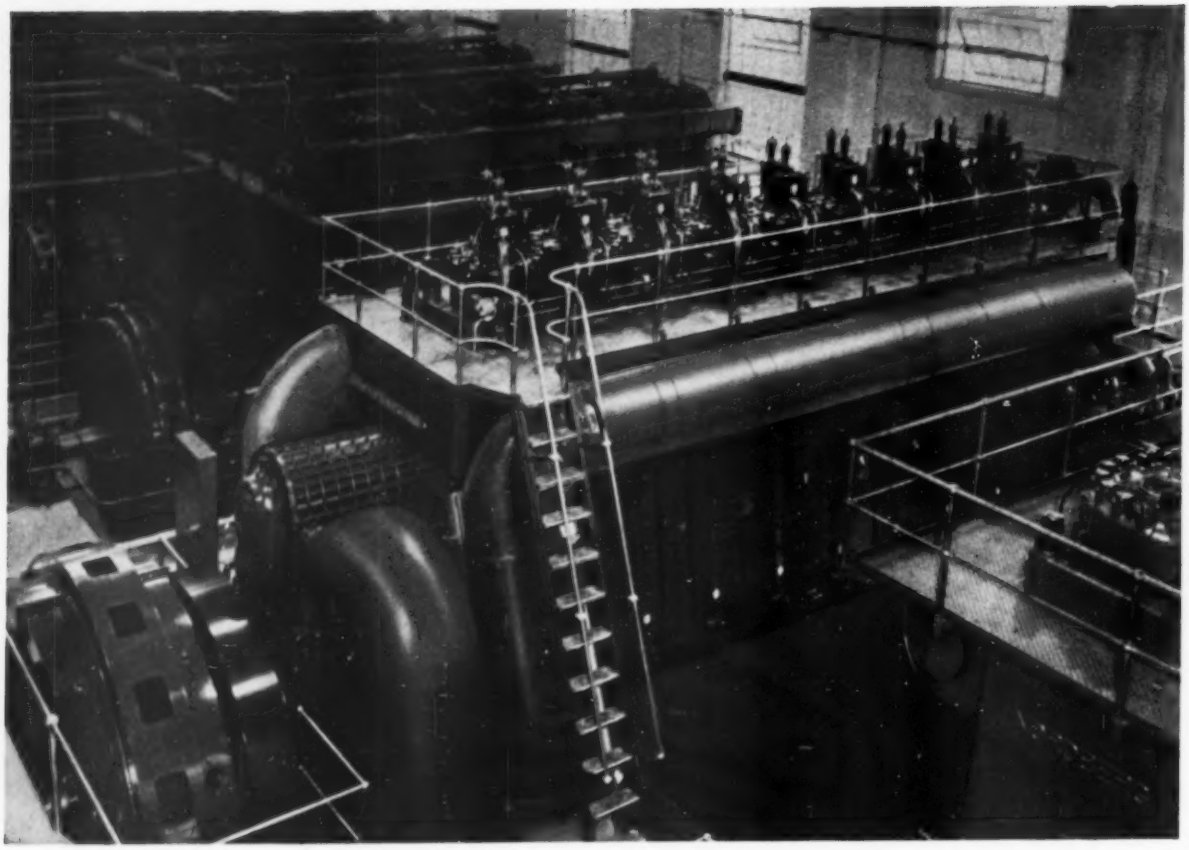

Largest Diesel Power Generating Station in the U.S.

reduces cylinder and piston ring wear with SHELL ROTELLA OIL

Electric power for the City of Grand Haven, Michigan, and the surrounding area, is generated by diesel engines in the largest municipal power station of its kind in the U. S. A. Shell Rotella Oil is the cylinder lubricant.

The anti-corrosive action in Shell Rotella Oil combats the major cause of engine wear . . . cylinder and piston ring wear caused by acid action from the by-products of incomplete combustion and condensation.

Tougher lubricating film in Shell Rotella Oil gives cylinders and rings greater protection . . . minimizes wear. Its effective detergent-dispersant action prevents harmful deposits.

Write for technical information. See for yourself how Shell Rotella Oil can help reduce your engine maintenance costs.

SHELL OIL COMPANY
50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

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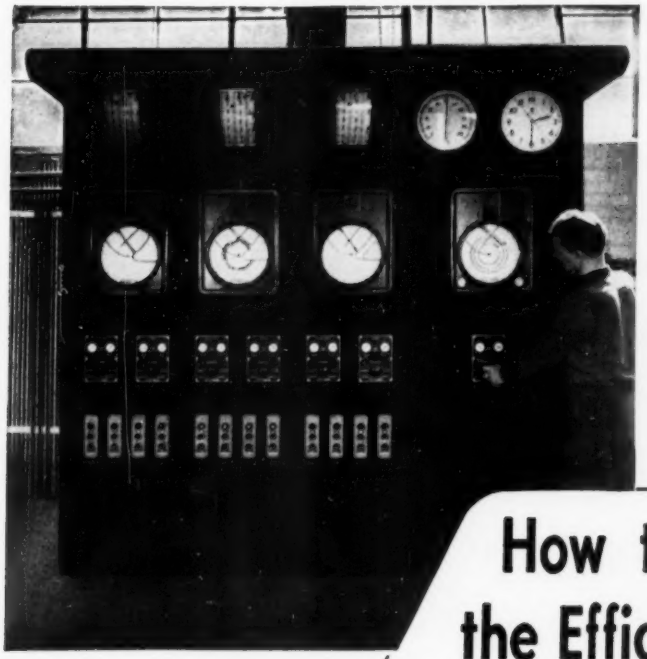

These Bailey Boiler Controls at the Chicago Pneumatic Tool Company's new plant in Utica, N. Y. insure efficient operation of three 25,000 lb per hour, 100 psi, spreader stoker-fired boilers

How to INCREASE the Efficiency of YOUR BOILER-ROOM DOLLAR

Before you get steam you've got to spend dollars—so dollars are a form of energy.

And if your boiler-room dollars are invested in equipment that isn't working efficiently, economically, your "investment" is poor.

That's where co-ordinated controls by Bailey can help. Here's why they'll increase your "boiler-room investment efficiency":

1. Complete Range of Equipment—fully co-ordinated. You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. Engineering Service—backed by experience. No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

3. Direct Sales-Service — conveniently located near you. Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

•

For better "boiler-room investment" efficiency—for more power per fuel dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

A-111-0

BAILEY METERS

BAILEY METER COMPANY

1040 IVANHOE ROAD
CLEVELAND 10, OHIO

Controls for Steam Plants
COMBUSTION · FEED WATER
TEMPERATURE · PRESSURE
LIQUID LEVEL · FEED PUMPS

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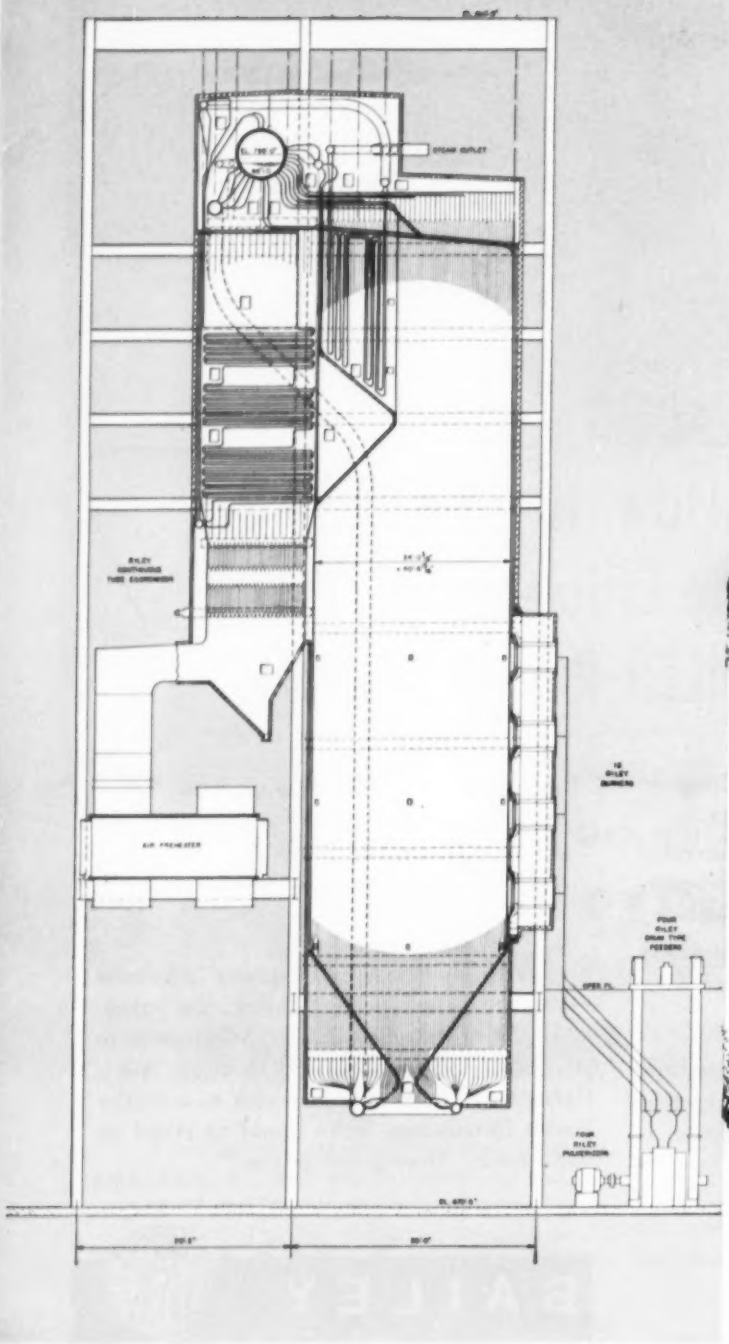


RILEY *adds another public utility to its growing list of users -*

Outdoor Unit for Columbus and Southern Ohio Electric's Picway Station is Designed for Operation with Ohio Strip Mine Coal under Peaking Load Conditions

900,000 lbs./hr. capacity
1500 psig design at superheater outlet
1350 psig operating pressure
950°F. temperature at superheater outlet

Furnace Heat Releases

13,500 B.T.U. per cu. ft. of furnace volume
85,000 B.T.U. per sq. ft. of furnace envelope

Furnace Width—40'7"
Furnace Depth—24'0 3/4"
Over-all efficiency 86.5%
Commonwealth Associates, Inc., Engineers

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs.

RILEY Stoker Corporation

WORCESTER, MASSACHUSETTS

Boston New York Philadelphia Buffalo Washington Pittsburgh Cleveland Detroit Chicago Cincinnati Charlotte New Orleans
Atlanta St. Louis Kansas City St. Paul Tulsa Houston Denver Salt Lake City Los Angeles San Francisco Portland Seattle

COMPLETE STEAM GENERATING UNITS

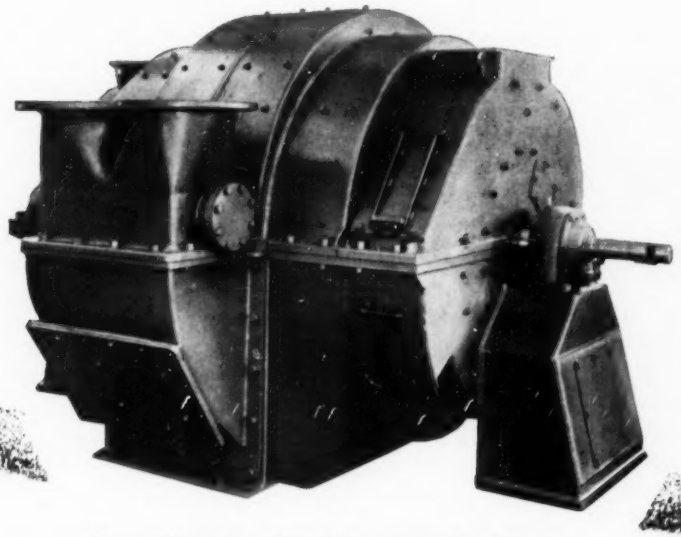
AND FUEL BURNING EQUIPMENT FOR PUBLIC UTILITIES, INDUSTRIAL POWER AND HEATING PLANTS

Columbus and Southern Ohio Electric Company to install this 900,000 pounds per hour Riley Steam Generating Unit

Clean and liberal design is one reason why acceptance of Riley equipment by public utility power engineers continues to maintain steady growth. This installation for Columbus and Southern Ohio Electric Company adds another unit to Riley's long list of sales to new and old customers.

Some Recent Riley Customers

If your company is considering additional steam generating facilities, it will pay you, as it has so many others, to investigate thoroughly the advantages of working with Riley.



Four Riley No. 550 Pulverizers for Quiet, Vibrationless Operation at Wide Load Ranges

Pulverizing parts faced with *erosion resistant* Tungsten Carbide assure sustained high fineness and low maintenance cost per ton over months of continuous operation. Capacity of each pulverizer is fifteen tons per hour.

For more data circle 513 on Post Card

New Orleans Public Service, Inc.
975,000 lbs./hr. 1750 psig design and 1005°F. Pressurized Furnace

Public Service Co. of Indiana, Inc.
805,000 lbs./hr. Reheat. 2075 psig, 1005°F. and 1005° Reheat
Sargent & Lundy, Engineers

Houston Lighting & Power Co.
2—1,250,000 lbs./hr. Reheat
2125 psig, 1005°F. and 1005° Reheat. Pressurized Furnace
Ebasco Services, Inc., Engineers

Dallas Power & Light Co.
1,050,000 lbs./hr. Reheat
1550 psig, 1005°F. Pressurized Furnace
Ebasco Services, Inc., Engineers

Texas Electric Service Co.
1,250,000 lbs./hr. Reheat
2125 psig, 1005°F. and 1005° Reheat. Pressurized Furnace
Ebasco Services, Inc., Engineers

Louisiana Power Company
1,000,000 lbs./hr. Reheat
1725 psig, 1005°F. and 1005° Reheat. Pressurized Furnace
Ebasco Services, Inc., Engineers

City of Los Angeles
Department of Water & Power
2—1,200,000 lbs./hr. Reheat
2075 psig, 1000°F., 1000° Reheat

Monongahela Power Company
The Potomac Edison Co.
2—700,000 lbs./hr. 1050 psig, 905°F.
Sanderson & Porter, Engineers

Southwestern Gas & Electric Co.
630,000 lbs./hr. 1025 psig, 1005°F.—Pressurized Furnace
Sargent & Lundy, Engineers

Central Illinois Light Co.
600,000 lbs./hr., 950 psig, 900°F.
Commonwealth Services, Engineers

Northern States Power Co.
385,000 lbs./hr., 1500 psig, 950°F.
Pioneer Service & Engineering Co., Engineers

South Carolina
Public Service Authority
460,000 lbs./hr., 1025 psig, 900°F.
Ford, Bacon & Davis, Engineers

Iowa Electric Light & Power Co.
300,000 lbs./hr., 975 psig, 910°F.

South Carolina Gas & Electric Co.
400,000 lbs./hr. 1475 psig, 955°F.
Gilbert Associates, Engineers

Utah Power & Light Co.
620,000 lbs./hr. 1500 psig, 955°F.
575,000 lbs./hr., 1700 psig, 1000°F., 1000° Reheat
Bechtel Corp., Engineers

Arkansas Power & Light Co.
650,000 lbs./hr., 1050 psig, 905°F.
Ebasco Services, Inc., Engineers

Gulf Power Company
325,000 lbs./hr., 1000 psig, 900°F.
Southern Services, Engineers

Iowa-Illinois Gas & Electric Co.
250,000 lbs./hr., 975 psig, 905°F.

Ohio Edison Co.
225,000 lbs./hr., 975 psig, 900°F.
Commonwealth Services, Engineers

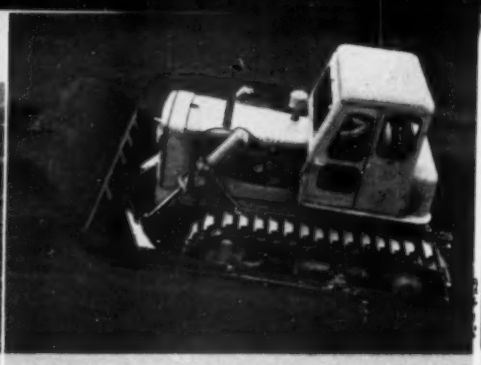
Mississippi Power Co.
230,000 lbs./hr., 925 psig, 850°F.
Southern Services, Engineers

Interstate Power Co.
200,000 lbs./hr., 725 psig, 910°F.
Sargent & Lundy, Engineers

Southwestern Public Service Co.
330,000 lbs./hr., 1050 psig, 900°F.

Stockpiles coal anywhere —
Coal brought in by water to Midwest chemical plant is economically hauled to stockpile, spread in 4-in. layers and compacted by Allis-Chalmers 41,000-lb., 175-net engine hp. HD-20 Tractor pulling scraper that carries 18 tons.

Stockpiles, compacts, loads —
Allis-Chalmers 40-drawbar HD-5G Tractor Shovel pushes coal onto stockpile, then with its 16,200 lb. plus added weight of loaded bucket compacts it, and finally with 2-yd. (1½-ton) bucket loads coal from stockpile to trucks for hauling to plant as needed.



Handles coke for steel mill —
Allis-Chalmers 72-drawbar hp., 18,800-lb. HD-9 Tractor dozes coke out onto stockpile, levels and compacts it, then reclaims it as needed. Freezing of coke surface in winter no longer hinders operation with tractors as it did with previous system.

Takes care of all coal handling . . .
This 109-drawbar hp., 27,850-lb. Allis-Chalmers HD-15 Tractor easily stores and reclaims all coal for an Eastern power plant.

Tractors Make Coal Handling More Flexible

Storing and reclaiming coal with tractors is considerably more flexible, as well as more economical, than with complex conveyor or crane systems. Tractor handling permits keeping equipment investment in close balance with current operating needs at all times. As demand increases, or if it is necessary to speed up handling during rush periods, more tractor units can be added. Also, storage areas can be abandoned without leaving money tied up in idle stationary equipment.

With tractors, coal can be stored wherever there is available space — and can be reclaimed whenever needed. Crawler tractors work free of rails and runways, make their own "roadway" anywhere. They can handle all coal moving — or will supplement existing facilities.

Work with Blades, Scrapers, Front-End Shovels

When unloading station is near storage area, tractors with bulldozer blades can economically move coal alone or work along with other equipment. Teamed up with scrapers, the tractors can haul coal to remote storage areas located anywhere. Tractor shovels are versatile units that can move coal to stockpiles and reclaim it, maintain piles, or load it to hoppers, cars or trucks.

Whether they work with blades, scrapers or front-end shovels, tractors spread coal out in thin layers and compact it well by constant travel over the pile. This tight packing of horizontal layers eliminates flues that cause spontaneous combustion in loose conical piles.

Handle Other Jobs, Too

Tractors offer additional versatility and flexibility through other than coal handling use. They also can take care of plant or yard maintenance, car spotting, snow removal, excavating, moving heavy equipment or materials, dozens of other jobs.

Find out more about how tractor equipment can improve coal handling for you. See your Allis-Chalmers industrial tractor dealer for a demonstration. Also, send for free booklet, "Economic Coal Storage with Allis-Chalmers Tractors."

ALLIS-CHALMERS
TRACTOR DIVISION · MILWAUKEE 1, U. S. A.

For more data circle 514 on Post Card

HELPFUL BULLETINS

INSTRUMENTS AND CONTROLS

101 Instruments for Steam Generation — Bulletin 9050, 32 pp, is a handy reference for all manufacturer's products applicable to steam generation, including electric, pneumatic, electronic and mechanical types of instruments and controls. Power engineers will find it useful in selecting instrumentation for modernization of package boilers. Minneapolis-Honeywell Regulator Co.

102 Boiler Water Level Controls — Catalog SC-5, 24 pp, is a revised edition of manufacturer's catalog of boiler water level controls and safety devices. Includes boiler feeders, low water cut-offs, pump controllers and relief valves, also special adaptations and components. Contains engineering information, including capacity curves and roughing-in dimensions, with parallel data on the different models tabulated for quick comparisons. Includes price sheet. McDonnell & Miller, Inc.

103 Controls for Liquids, Gases — Bulletin 004, 36 pp, is a revised edition of company's general catalog on measuring and control equipment. This practical book contains information on many types of controllers, gages, manometers, recorders, meters, valves, Venturi tubes etc., applicable for water and sewage works, power and processing industries. Simplex Valve & Meter Co.

104 Indicating, Recording Instruments — Catalog 5001, 28 pp, revised component booklet, describes and illustrates millivoltmeter pyrometers, electronic potentiometers, thermometers and pressure gages. Gives comprehensive coverage of products. Industrial Div., Minneapolis-Honeywell Regulator Co.

105 Automatic Controllers — Bulletin 52-606 is a 48-pp guide to the selection and application of automatic instruments for the measurement and control of pressure, flow, speed and level. Provides general discussion of their accuracy, sensitivity, speed and power, and describes four essential elements of controllers: measuring element, pilot device, transmission and power unit. A variety of instruments are described and pictured and their operation diagrammed. The Hays Corp.

106 Water Gages — Recent improvements made in this company's flat-glass high pressure water gages are described in 20-pp Catalog WG-1812 covering boiler water columns and gages. It provides details on the round-glass gages for pressures up to 400 psi and the flat-glass gages featuring separated-design, floating assembly and inserts and Type M illuminators for pressures to 2500 psi. Yarnall-Waring Co.

107 Shunt Flow Meters — This article, "Dual Ranging Shuntflo Meters by Means of Squires Pressure Reducing Valves" is a progress report on a means for increasing the accuracy of steam flow metering, where the flow rate varies and may be below 10 per cent of the maximum rate. Describes the system used to obtain accuracies of 2 per cent over a wide range and variable steam use load. Builders-Providence, Inc.

108 Flow Meters — Catalog 2320, 58 pp, fully illustrated, describes all types of manufacturer's flow meters, including indicating, recording, integrating and controlling instruments of evenly graduated and square root types, as well as area meters and differential converters. Includes tables on flow approximations, installation information, factors necessary to determine if fluid to be measured can be properly handled. Industrial Div., Minneapolis-Honeywell Regulator Co.

109 Panel Instruments — Bulletin GEC-368F, 12 pp, illustrated, describes, gives construction, application information on company's line of a-c and d-c panel instruments. Includes dimensions, prices, physical, operational and electrical data. General Electric Co.

110 Electrodes, Electrode Assemblies — Catalog EN-85, 20 pp, describes electrode assemblies for measurement, recording, and/or control of solution pH and redox potentials. Covers manufacturer's electrode line, chemicals for servicing, auxiliary equipment including clamps, thermometers. Leeds & Northrup Co.

111 Panel Instruments — Catalog N-1, 8 pp, presents a new method of listing manufacturer's instruments and accessories, their outstanding characteristics, and prices, for both d-c and a-c. Catalog is designed to help user visualize best combination of factors in design and prices for his own needs. Burlington Instrument Co.

112 Input Controller — Bulletin 654 describes, gives specifications on company's Truetemp input controller which is added to an existing "on-off" temperature control system that is thermocouple actuated, to provide furnace or heating control as close as ±0.2 F. Explains controller is designed to improve heat processing, reduce losses. Winslow Co.

PUMPS AND PUMPING

113 Screw Pumps — Twelve-pp Bulletin S-205 is devoted to company's standard gear-in-head, high pressure long body gear-in-head, and standard vertical gear-in-head types. Basic construction and design are discussed in detail and there are sectional views with indicated features, also installation pictures. Dimensions and specifications are included. Warren Steam Pump Co., Inc.

114 Centrifugal Pumps — Bulletin 1001B, illustrated, presents full-pp cutaway diagram of company's Type GS centrifugal pump, in sizes from 2½ to 4 in., capacities to 400 gpm, and heads to 230 ft. Describes maintenance and service features. De Laval Steam Turbine Co.

115 Sump Pump Selector — Bulletin 54-3-1420, 20 pp, provides a selection table allowing a power engineer to choose any of the 4000 models of the BJ Sumpmaster pumps, which range from 10 to 2600 GPM with heads from 20 to 300 ft. Includes complete dimensions and outline drawings, simple coding system for ordering. Byron Jackson Co.

116 Centrifugal Pumps — Bulletin 4011, 12 pp, gives design features, construction materials on the new end suction centrifugal pumps, sizes from 1 to 5-in. discharge; capacities to 1000 gpm; maximum heads to 250 ft — with electric motor, or for belt drive or pump only. Contains 7 pp of performance tables and curves (1750 and 3500 rpm); approximate dimensions in inches. The Deming Co.

117 Metering, Proportioning Pumps — Bulletin KP-54, 6 pp, describes manufacturer's line of "K" Type metering and proportioning pumps and their operation. Gives capacity and pressure information on entire line. Hills-McCanna Co.

118 How to Select a Motorpump — Bulletin F.7123 is a 16-pp booklet form slidefilm which tells how to select the proper motorpump for any specific job. Describes a centrifugal pump and how it works, discusses such factors as quantity, pressure, friction losses. Presents a typical problem and its solution by means of charts and curves. Ingersoll-Rand Co.

PACKINGS, SEALS

119 Teflon Packing — Bulletin 461 M. D. introduces Dura plastic packing for chemicals. Illustrated spiral type and die molded rings of this lubricated Teflon packing, explains how it solves sealing problems of handling corrosive chemicals. Durametallic Corp.

120 O-Ring Applications — This 16-pp brochure, Catalog 9B, documents the production and application of rubber O-ring seals. Includes sections on end products, sizes, dash numbers and variable tolerances, dimensional data for installation of standard size o-rings, drawings of correct and incorrect installations, and methods of utilizing O-ring sealing properties. Minnesota Rubber and Gasket Co.

The new and revised publications reviewed on these pages offer help on many operating and maintenance problems. To order them, use the Reader Service Cards on pages 107-108

MATERIALS HANDLING

121 Engineered MH Systems — Bulletin 400, 32 pp, presents eight examples of company's material handling systems. They cover installations for handling bulk chemicals, metal chips, grain, coal and other bulk materials, and each system is described, illustrated and diagrammed. Bulletin gives technical information on enclosed elevators and covers en masse, screw, vibrating, flight and other types of conveyors. A section on mechanical methods of transferring or feeding bulk

materials is included and company's testing services described. Gifford-Wood Co.

122 Ratchet-Lever Hoists — Bulletin SP, 8 pp, describes ratchet-lever hoists, including both roller and coil-chain models, with capacities ranging from ¾ to 15 tons. In addition to giving safety and performance features and listing specifications, booklet illustrates ratchet-pawl construction and quick-disassembly feature of the coil-chain hoists. Includes action photos. Coffing Hoist Co.

123 Screw Conveyors — Described and illustrated in 4-pp Catalog and Engineering Data Book ID-541 are various sizes and types of screw conveyors. Engineering data is provided to help power engineers select proper conveyor and accessories. Tables are included for determining correct speeds and horsepower. Booklet also shows many unusual types of conveyors and gives their applications. Industrial Div., Continental Gin Co.

METALS

124 Alloy Castings — Some 175 applications of heat and corrosion resistant alloy castings are discussed, illustrated in Bulletin A-141, 48 pp. Charts compare creep strength of various alloys, resistance to corrosion in certain media, and to oxidation at elevated temperatures. Tables of composition list principal Alloy Casting Institute designations, proprietary alloys. The International Nickel Co., Inc.

125 On Major Stainless Alloys — This new technical booklet consists of 11 reference sheets covering major stainless alloys. For each alloy the following information is given: chemical composition, mechanical and physical properties, resistance of major corrosive solutions, machinability, heat treatment and weldability. Also, the equivalent ACI, AISI, SAE and ASTM designations are given. The Cooper Alloy Foundry Co.

BOILERS AND GENERATORS

128 Steam Generators — Bulletin MH 3-54, 16 pp, discusses Type MH packaged water tube steam generator for oil and /or gas firing, with automatic, semi-automatic or manual combustion controls. Includes cutaway illustrations, installation photos, tube arrangement layouts, and a dimension table for 13 standard sizes from 10,000 to 40,000 lb of steam per hr. Union Iron Works.

129 Small Boilers — Bulletin AD-134, illustrated, introduces manufacturer's "CB" line of small boilers in 15 to 40 hp (15 to 150 lb steam, 30 lb hot water) for heating and processing. Discusses advantages of silent operation, fuel economy, electric combustion safety control. Includes drawings, specifications on four models. Cleaver-Brooks Co.

MAINTENANCE

130 Industrial Painting — A precision painting service, including necessary preparatory operation, available for power stations, plant interiors, machinery, conveyors, piping and tanks, is described in this 8-pp illustrated bulletin. Subjects treated include general and spray painting, preparatory work, protective coatings, roof coatings, concrete restoration, waterproofing, insulation. Murray Brothers.

131 Tank Cleaning — Advantages of cleaning tanks with inhibited chemical solvents are discussed in this 4-pp bulletin. Chart on back shows typical examples, specifications, of industries using company's service. Dowell Inc.

132 To Seal Leaks and Cracks — This 48-pp illustrated repair handbook presents methods of mending leaks in pipes, boilers, radiators, concrete and cinder blocks, sheet and plate metal with manufacturer's repair cements. Describes 12 repair cements. Smooth-On Mfg. Co.

. . . Outstanding Among This Month's Catalogs . . .

126 Proper Lubrication — Presenting proper lubrication as the life blood of all machinery, 36-pp Lubriplate Data Book 54-1 is a helpful treatise on modern lubrication practice. Gives product data on both oil type lubricants and greases and discusses choice of lubricants for use in applications involving heavy loads, high speeds, extreme temperatures, water conditions and other metal working. Provides tables of specific recommendations for various classes of equipment in food processing, chemical processing, metal working, paper and other industries. Lubriplate Div., Fiske Brothers Refining Co.

127 Demineralizers — Valuable information on demineralization is offered power engineers in comprehensive 24-pp Bulletin WC-111. Discusses demineralization in general and its advantages and applications. Basic types of demineralizers and their special uses are charted. Resins, piping, valves and accessory equipment are treated in detail. Book also provides flow charts showing demineralization systems for chemical plants and power plants, and includes operating cost estimation curves. Graver Water Conditioning Co.

133 Heating, Ventilating Units — Catalog 1620, 40 pp, helps the power engineer plan, specify and order heating and ventilating units (air volumes from 1200 to 23,000 cfm; heating capacities from 100,000 to 2,500,000 Btuh) for moving, heating or cooling of air. Five data sections cover descriptive, performance, layout, engineering and service. For determining unit size, a step-by-step procedure is included. Hypothetical problems show proper use of performance data, curves and charts in selecting correct unit. Sturtevant Div., Westinghouse Electric Corp.

134 Steam Trap Solutions — Bulletin F.151, 36 pp, is a newly revised edition of this company's well known booklet, "Solving Steam Trap Problems." Organized for easy reference, this illustrated booklet provides specifications and capacities of steam and float traps, air release valves, pipe line strainers. Tells how to calculate condensation loads and select traps for unit heaters, jacketed kettles, submerged surfaces. Gives pointers on installing and servicing traps. Also included in this edition is information on combination float-thermostatic traps for fast air venting. The V. D. Anderson Co.

It's easy to get these free catalogs—just circle item numbers of those wanted on the two post cards provided on pages 107-108.

ELECTRICAL EQUIPMENT

135 Distribution Transformers — How to distribute secondary loads and temporary overloads economically is told in Bulletin 61B8054. Shows how secondary banking improves service by connecting transformer capacity so that temporary overloads are distributed among two or more transformers. Describes basic construction of transformers in secondary banking systems. Allis-Chalmers Mfg. Co.

136 Dry-Type Transformers — Catalog H-10-101, 16 pp, describes four groups of manufacturer's dry-type air-cooled transformers (0.1 to 300 kva), each available in auto type or double wound, with standard light and power in each case. Contains descriptive information, diagrams of dimensions, schematic diagrams, specification charts, list prices. Harrison Transformer Corp.

137 Voltage Regulators for Rural Lines — Bulletin B-6054, 20 pp, discusses in non-technical style, rural application of voltage regulators. Gives theory of application on rural lines; describes various types of manufacturer's regulators. Westinghouse Electric Corp.

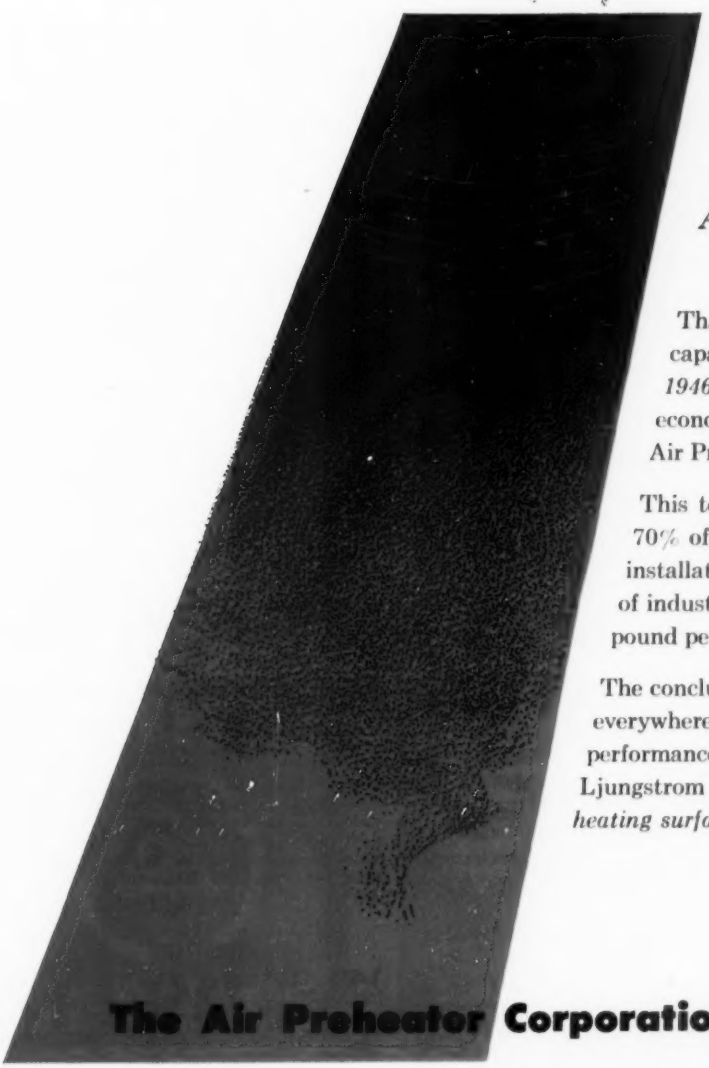
138 Regulated Power Equipment — Catalog 254, 32 pp, covers company's line of electronic a-c voltage regulators, regulated d-c sources and B supplies, electronic frequency changers, inverters, magnetic-amplifier d-c sources, and related equipment. Besides giving abundant general information on the operating principles of these instruments, booklet explains reasons for regulating line voltage and advantages of electronic regulation. Includes full data on each instrument — pictures and specifications. Sorensen & Co., Inc.

139 Instrument Transformers — This 30-pp catalog presents basic information required for specifying instrument transformers. Includes factual data on current and potential transformers for indoor and outdoor applications. In addition to photos and descriptive text, booklet provides performance data, dimensional drawings, tables showing cost and weights for various ratings. Gives information on transformers for 12 types of applications. R. E. Uptegraff Mfg. Co.

140 Busway System — Bulletin 40, 44 pp, catalogs company's "100" amp steel-enclosed trolley busway system of electrification. Illustrates and describes track, trolleys and accessories used in the electrification of cranes and hoists, assembly and production lines, portable and machine tools and other moving equipment that must be powered. Booklet is sectionalized to facilitate selection of equipment. Special sections deal with installation planning and procedure, methods of mounting. Feedrail Corp.

141 Current-Limiting Reactor — Bulletin B-5918 describes Type MSP self-shielded current-limiting reactors for installation on industrial branch circuits. Shows how these reactors cut costs by eliminating need for complete new protec-

420,000,000 pounds of steam per hour



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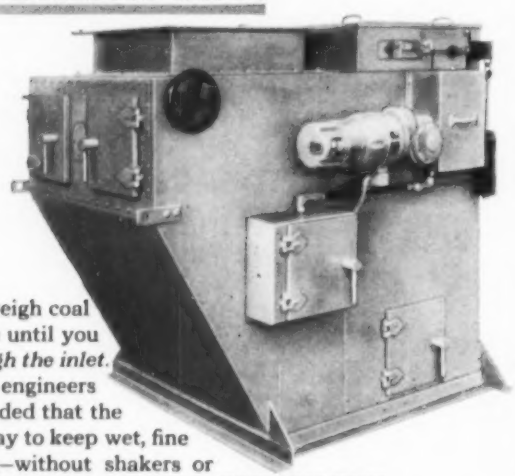

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tion equipment when "powering up" your main bus capacity, and permits purchase of lower rated protective apparatus for new installations. Discusses use of Hipercrete shields to confine stray flux, describes 12 designs. Westinghouse Electric Corp.

142 Low Voltage Switchgear — An extremely helpful manual for laying out low voltage switchgear, 36-pp Bulletin 200 is well illustrated and organized for easy use. Presents basic types of circuit breaker switchgear along with their special applications and advantages. General features and such subjects as assembly, bus structure, compartments, external connections are covered. Specifications are also provided, and data on instrument transformers are included. Continental Electric Equipment Co.

143 Outdoor Metering — Booklet B-5916 describes outdoor metering outfits (Type MP) in three-phase from 2.4 to 115 kv, single-phase from 15 to 161 kv. Points out Type MP combines potential and current transformers in one tank. Cites advantages of easily removed bushings, low insulation power factor, weather-proof junction box. Westinghouse Electric Corp.

WATER TREATING

144 Mixed-Bed Demineralization — Bulletin 3983, 8 pp, shows how use of a fully automatic mixed-bed equipment to produce make-up water cuts operation costs. Gives operating description of process, shows installed equipment together with a schematic diagram of demineralizer control arrangement. The Permutit Co.

145 Water Softener — Publication 4505-A describes the Zeo-Flo, a sodium zeolite softener especially designed for small and medium size industrial plants, laundries and institutions. Stresses ease of installation, low cost, minimum piping requirements and other advantages of the unit's simplified design. Explains operation, provides dimensional data, capacities. Cochrane Corp.

146 Reducing Condensate Line Corrosion — Attributing condensate line corrosion chiefly to carbon dioxide in the steam and water, Technical Paper 127 discusses various methods of minimizing boiler feedwater alkalinity, especially the use of filming amines. Cites results under various conditions. W. H. & L. D. Betz.

147 Water for Industry — "Sources of Water," 6-pp folder, discusses water-procurement problems; gives examples from organization's experience in meeting various plant water requirements. Hall Laboratories, Inc.

148 Industrial Waste Treatment — Advantages inherent in the treatment of industrial waste waters and process liquors are described in Bulletin WC-116. Schematic drawings, pictures and a problem-solution-result type of explanation show how company's equipment solves such problems as process and cooling water shortages, contamination of streams with plant effluents, and the loss of valuable heat and materials in discarded waters. Graver Water Conditioning Co.

TURBINES

149 Mechanical Drive Turbine — Bulletin H-22, 16 pp, shows design features, proper control of manufacturer's Type YR mechanical drive turbine. Lists modifications for special applications, ma-

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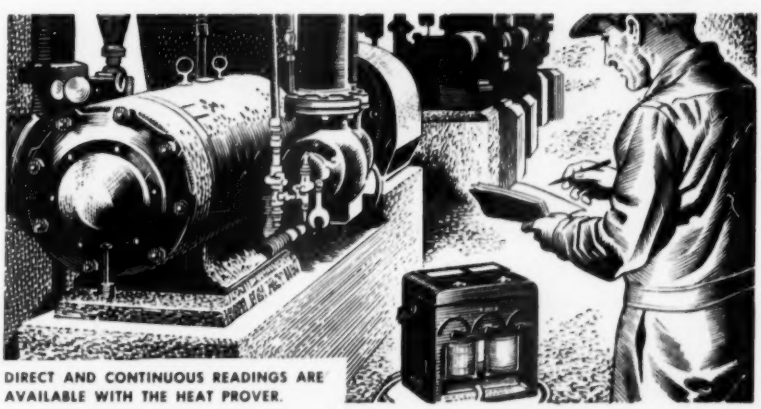

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terial specifications, dimensions for each frame. Elliott Co.

150 General Purpose Turbines — Bulletin B-3896, 20 pp, fully illustrated, covers manufacturer's complete line of Type E turbines in ratings through 1500-hp. Describes design and constructional characteristics, accessories which make units adaptable to special requirements. Discusses applications as drives for pumps, fans, compressors, generators; provides specifications and selection data. Westinghouse Electric Corp.

151 Turbine Speed Control — Thirty-pp wire-bound Bulletin H-21 is titled, "Fundamentals of Turbine Speed Control." It is an elaborately illustrated, educational booklet intended to clarify the operation of common types of automatic speed control for steam turbines. An introductory section covers general fundamentals of automatic control systems, and includes a key to control terminology. Simplified diagrams show operating principles of actual control systems. Elliott Co.

FANS

152 Heavy Duty Fans — Eight-pp Catalog 1380 describes three classes of company's Series 2000 heavy duty fans for induced draft service. Gives maximum wheel speeds, total pressures, volume ranges. Presents graph of certified hp, efficiency and pressure rating of new blade design, factors contributing to ratings. Includes section on optional inlet damper control. Sturtevant Div., Westinghouse Electric Corp.

153 Industrial Fans — Propellair Bulletin 650, 12 pp, contains dimensions, application, and performance data on Tubeaxial and Stackbooster fans. Gives information on cooling and drying problems, system and open surface tank ventilation. Robbins & Myers, Inc.

REFRACTORIES

154 Refractories Handbook — This 126-pp handbook on fire clay refractories includes all of manufacturer's products, including firebrick, ladle and burner bricks, tiles. Provides tables, charts, other data for using, installing or specifying fire clay refractories. Booklet is sectionalized, contains section finder for quick location of information. Walsh Refractories Corp.

155 Refractory Data — Two refractories — Coleman XX for high duty service, and Coleman for intermediate duty service — are detailed in this 8-pp bulletin. Besides descriptive details, the bulletin includes charts showing spalling resistance, load test results, and thermal expansion. Harbison-Walker Refractories Co.

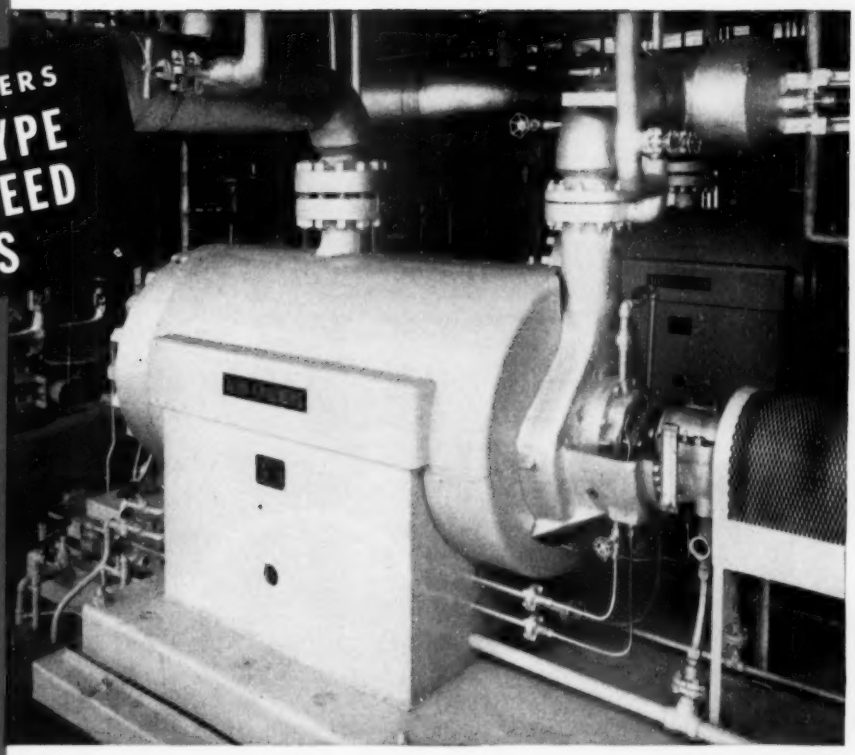
VALVES, PIPING AND ACCESSORIES

156 Ball Valves — Eight-pp Bulletin 159 introduces a line of manually-operated ball valves in sizes from 12 to 48 in. for shut-off service at pressures to 150 psi for water works and industrial applications. A technical section on valve characteristics covers closing conditions, tightness of closure, leverage, operating mechanism. Valve Div., S. Morgan Smith Co.

157 Valve Chart — Form 194, 24-pp, is a valve comparison chart, listing valve figure numbers of 15 major manufacturers and the OIC equivalent valve figure numbers. Compares variety of valves in ferrous

ALLIS-CHALMERS

BARREL-TYPE BOILER FEED PUMPS



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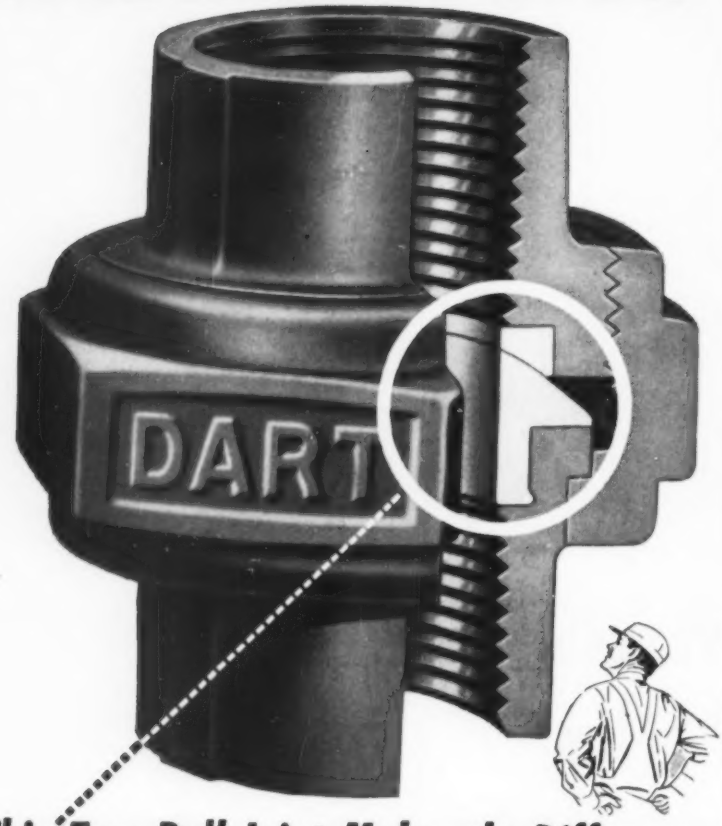

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and non-ferrous materials, describes different valve lines. The Ohio Injector Co.

158 Steam, Liquid Control Equipment — Catalog 54, a 56-pp edition commemorating this company's 40th anniversary, is arranged for easy reference. Covers pressure regulators, temperature regulators, combination regulators, float valves, strainers, pop safety valves, relief valves, diaphragm valves, motor-operated and solenoid valves. In this book, tabular matter is simplified for quicker reading of specifications. Included are quick reference tables on pressures and temperatures, and flange data. O. C. Keckley Co.

159 Steam Valve Calculator — A slide-chart calculator that quickly estimates pressure drop and indicates proper size steam valve needed for any pressures up to 1500 psi is now available. Printed on calculator are operating instructions. Golden-Anderson Valve Specialty Co.

160 Pipe Repairs for Any Leak — Illustrated Catalog 54, 32 pp, describes, gives specifications of manufacturer's line of steel, cast iron pipe repair clamps, service saddles, valve and bibb resealers. Tells how to repair all types of leaks in water, steam, gas, oil lines, also gives installation tips. M. B. Skinner Co.

OTHER EQUIPMENT

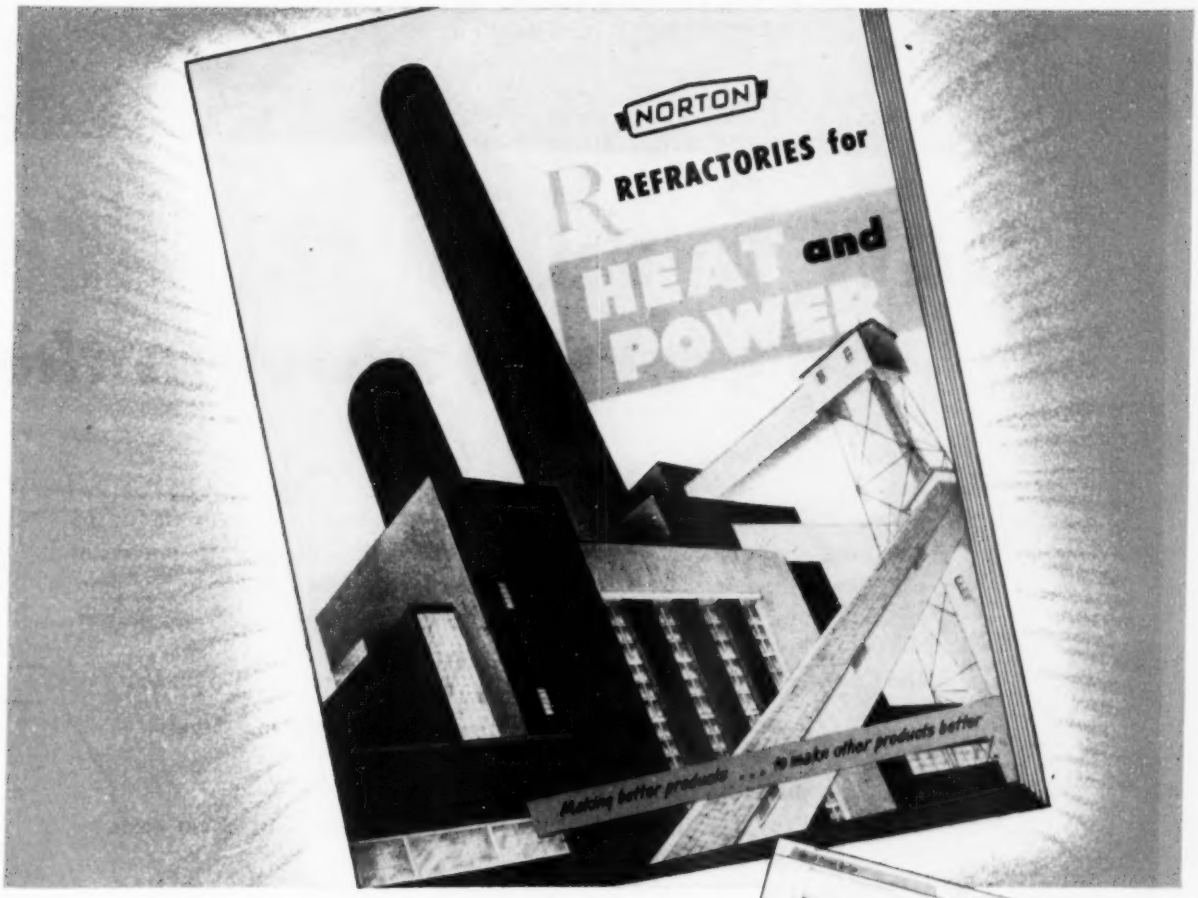
161 Improved Hose Coupling — A quick connect-disconnect hose coupling for water, oil, steam, gas and chemical lines is described in this 16-pp bulletin. Describes the coupling's construction and explains how it provides a sealing action which makes the coupling tighter as internal pressure increases, and a full swiveling action that prevents hose twisting and kinking. Titeflex, Inc.

162 Graphitization Study — A study on graphitization (a phenomenon of carbon migration in the heat affected zone of welded piping in high temperature service), is available in reprint form to power engineers who were unable to obtain copies of the original article, offered some time ago. The 12-pp reprint discusses graphitization from the standpoint of temperature, chemical composition, deoxidation practice, welding conditions, stress and strain. Edward Valves, Inc.

163 Aluminum Duct Systems — This 32-pp technical booklet, is designed to give power engineers practical data on friction losses in air conditioning duct systems. Contains graphs determining friction losses in round aluminum ducts and fittings; computations for duct heat loss or gain. Gives step-by-step design procedures for sizing round and rectangular ducts. Kaiser Aluminum & Chemical Corp.

165 Safety for Welding Operators — This practical, 32-pp illustrated booklet for welding and cutting operators handling oxyacetylene and arc welding equipment, gives safety cautions and rules for personal safety, handling and maintenance of cylinders, torches, regulators and hoses. Discusses safety practices in all phases of equipment use. Air Reduction Sales Co.

166 Temperatures to Figure? — This handy chart determines Fahrenheit and Centigrade temperature equivalents for you. Its reverse side shows the easy reading qualities of this company's thermometers made with glass red reading column. The chart is 8½ by 3½ in. You can keep it in your pocket or under a glass desk top. Moeller Instrument Co.



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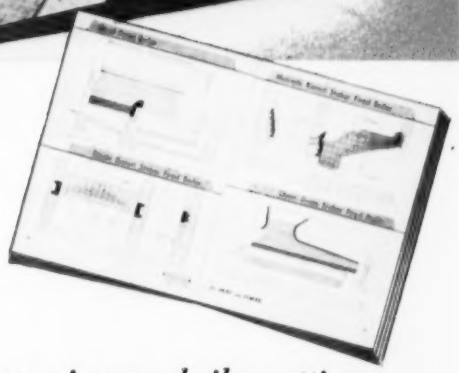


A basic guide to more efficiency and economy in your boiler settings

Compiled to help you solve refractory problems affecting boiler operations, this new Norton booklet is now ready for immediate mailing to your plant.

Here you'll find 32 pages of easy-to-read, money-saving facts, together with explanatory charts, diagrams and photographs describing the many uses and advantages of Norton CRYSTOLON* refractories for heat and power applications.

The right Rx for every boiler need

This booklet gives you full information on the best protection for water tubes; for the construction of air-cooled and solid walls; on laying bricks and making general repairs; on the correct refractories to use for every type of boiler. The properties of various refractories are thoroughly described and there are handy quick-figuring charts for temperature conversion, boiler efficiency, etc.

Remember, these refractories are *engineered and prescribed* by Norton to save you time and money in your heat and power requirements. This booklet tells you how. Send for your copy today. NORTON COMPANY, 616 New Bond Street, Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto 5, Ontario.

NORTON REFRACTORIES

Engineered . . . Rx . . . Prescribed

Making better products . . . to make other products better

*Trade Mark Reg. U. S. Pat. Off. and Foreign Countries

For more data circle 521 on Post Card

B&W Cyclone Furnace
a growing factor in the

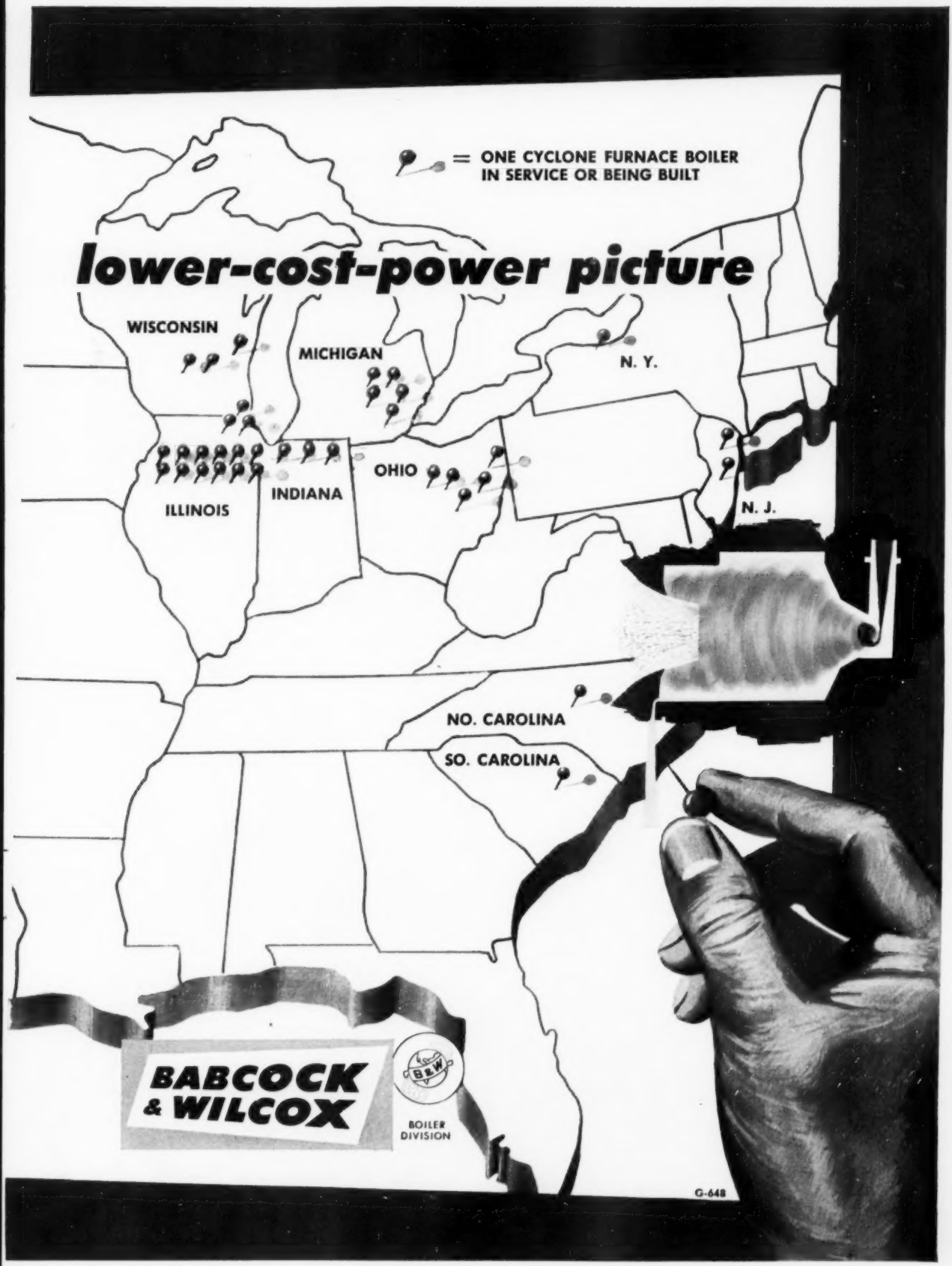
Cost-saving advantages vital to power plant operators are responsible for the mounting acceptance of the Cyclone Furnace. Each represents an important advance in the relentless search of power engineers and designers for more efficient ways to further lower the cost of generating steam for power.

The Cyclone Furnace—

- **Reduces atmospheric pollution to extremely low levels**
- **Simplifies ash handling and disposal**
- **Burns fuel with greater efficiency**
- **Provides greater fuel flexibility with attendant lower costs**
- **Reduces overall first cost**
- **Increases safety by simplifying operation**
- **Reduces maintenance**
- **Increases availability**

Originally designed and developed to burn more efficiently a wide range of coals, as well as oil and gas, the Cyclone Furnace is now being installed in areas where factors other than fuel are prime contributors to higher power generating costs. For whatever the problems — fuel, fly-ash, availability, cost, maintenance — the Cyclone Furnace contributes directly and substantially toward solving them.

With its revolutionary approach to the entire process of preparing and burning fuel, the B&W Cyclone Furnace offers such a simplification of initial design and increased facility in everyday operation, that the overall cost of producing power is greatly benefited. Let us discuss with you the various cost-saving advantages of the Cyclone Furnace for your operation. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.



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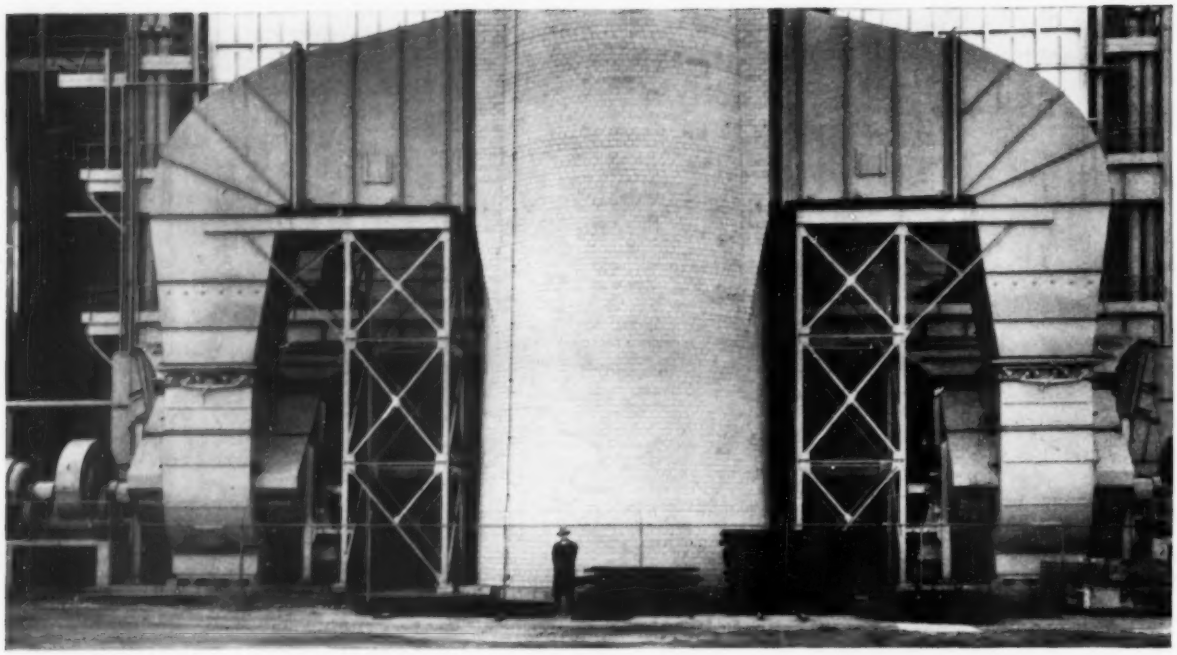


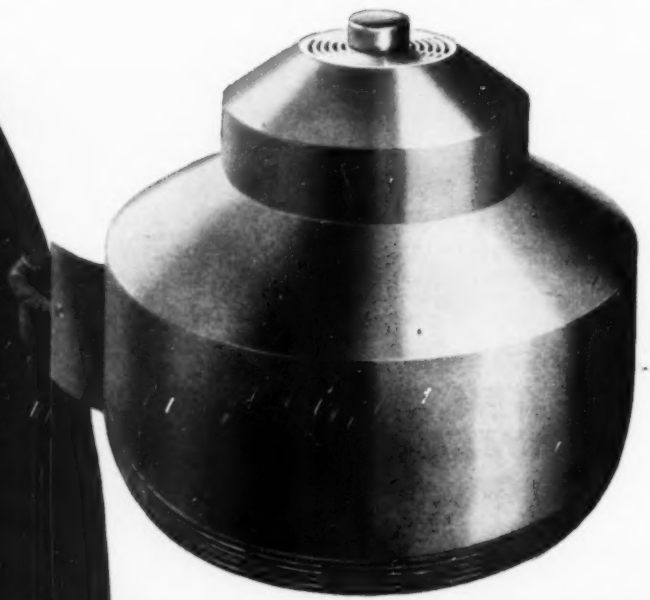
SHEET and PLATE FABRICATION for POWER PLANTS

● breechings ● air & gas ducts ● stacks ● casings ● bins and hoppers
● louvers ● exhaust piping ● insulation jacketing ● control panels and desks

WHATEVER YOUR REQUIREMENTS IN SHEET AND PLATE FABRICATION...CALL ON **KIRK AND BLUM**

The fabrication of sheet steel and plate to exacting specifications has been a specialty of Kirk & Blum for more than 47 years. Exceptional experience and complete facilities up to ½", in carbon steel, stainless, aluminum, monel and other alloys.

Send prints for prompt quotation or write for your copy of the latest Kirk & Blum Sheet and Plate Fabrication catalog.



THE KIRK AND BLUM MANUFACTURING CO. 3230 FORRER STREET, CINCINNATI 9, OHIO

For more data circle 523 on Post Card

Proof of PERFECT* Water Treatment PERFORMANCE

Nearly 12 billion pounds of steam have been generated inside this boiler and its twin. Boilers have never been acid cleaned. Tubes have never been turbined. All water side surfaces are clean-to-metal.

TURN THE PAGE FOR MORE FACTS ON HOW IT WAS DONE

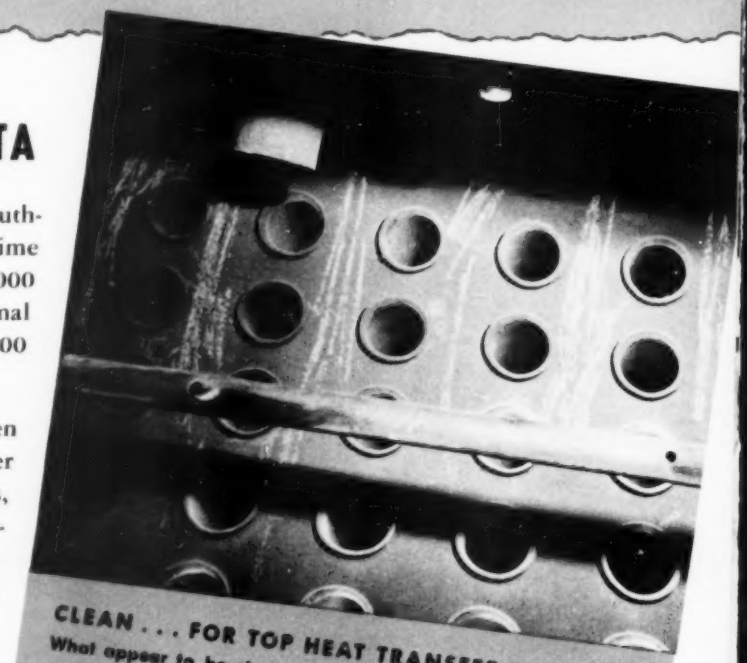
*We at think at least 99%!

BOILER OPERATING DATA

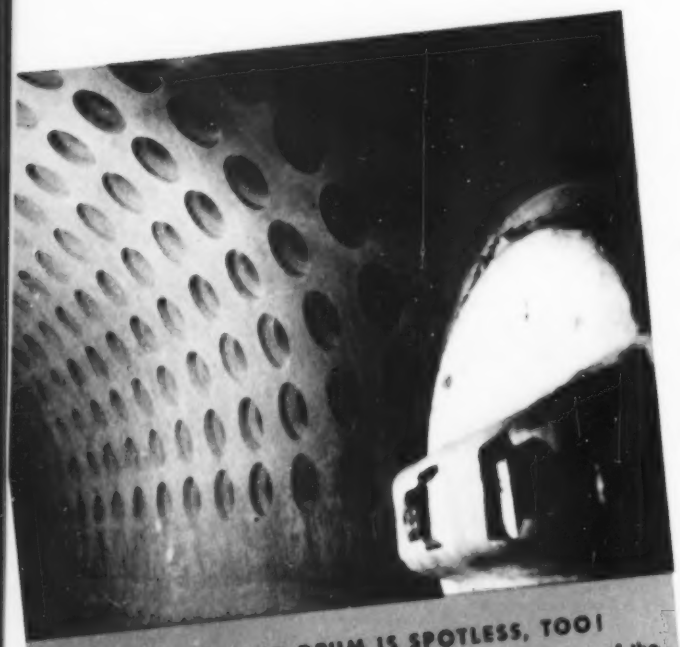
● Two new boilers were put on line in a Southwestern municipal utility plant at the same time late in 1949. Rated capacity of each unit is 250,000 pounds of steam per hour at 950 p.s.i. Normal operating rates range from 150,000 to 175,000 pounds of steam per hour per unit.

The Nalco System of water treatment has been used continuously in these boilers. Raw water softening is by Nalcite* Ion Exchange Resins, and other Nalco products are used for after-treatment, internal treatment, and condensate return line protection. Results have been perfect. Boilers have never been turbined or acid cleaned, and are opened only for annual internal inspection.

*Registered Trademark



CLEAN . . . FOR TOP HEAT TRANSFER EFFICIENCY
What appear to be chalk marks in this unretouched photo are scrape marks which indicate only the usual powdery film left on the metal when the boiler is drained.



AND THE MUD DRUM IS SPOTLESS, TOO!
Another unretouched photo inside the mud drum of one of the boilers shows the like-new condition after years of service. No deposits or corrosion of any kind have been found in tubes or drums.

Nalco ON THE JOB

● Results like these are encountered every day in plants when the complete Nalco System of water treatment is on the job. The Nalco System is adaptable to old and new plants of any capacity, temperature, or pressure. Whether you operate a public utility or a space heating boiler, you will find your Nalco Representative of real assistance in the solution of your water treatment problems. Call him today, or write for full information.

NATIONAL ALUMINATE CORPORATION
6216 West 66th Place • Chicago 38, Illinois
In Canada: Alchem Limited, Burlington, Ontario

THE *Nalco*® SYSTEM . . . Serving Industry through Practical Applied Science

Sure, that old pump still works,

but how much does it cost to keep?

That rugged old pump of yours may not be the bargain that it seems. Let's do some arithmetic. If the efficiency of the old pump is 75% vs. the 85% efficiency of the new pump, you are paying more to keep it than you would to replace it. That's because a new unit of equivalent output uses less power. Thus it soon saves its own cost — then begins to pay dividends.

Let's take a specific example — a small boiler feed pump

Old pump efficiency 63% . . . . . 99.5 BHP
New pump efficiency 69% . . . . . 91.0 BHP
8.5 BHP Saving

On the basis of 1¢ per KWH, the 8.5 BHP saving for 8,760 hours (a year of continuous operation) amounts to $560. This saving, capitalized in 10 years at 4%, adds up to $6,700. Yet the price of the new pump that saves $6,700 is only $1,101.

What would the pump replacement profit be in your particular case? Your De Laval representative can tell you exactly — in dollars and cents — as soon as he has the basic facts on your present installation. Call him in today or write to De Laval for Pump Fax Bulletin which includes a valuable "power-savings" chart.

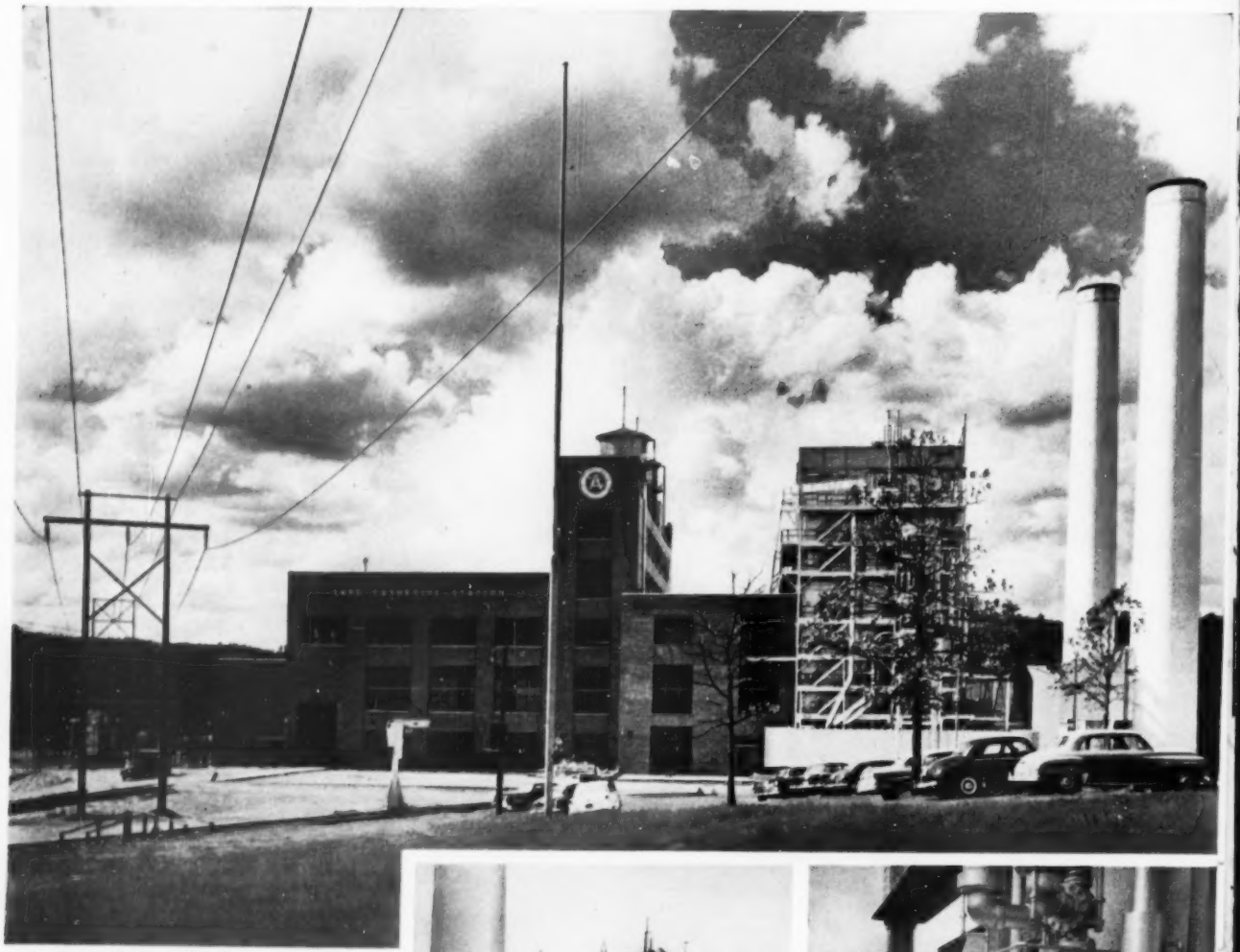
DE LAVAL *Pumps*

DE LAVAL STEAM TURBINE COMPANY
816 Nottingham Way, Trenton 2, New Jersey

01297

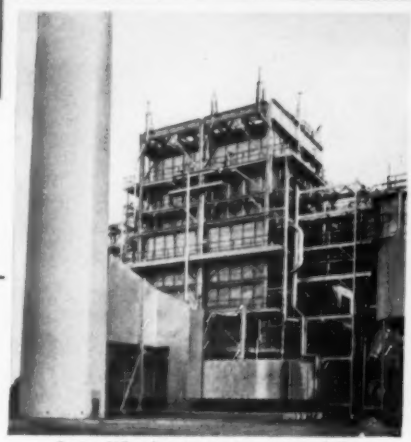
For more data circle 525 on Post Card

FOUR MORE OUTDOOR

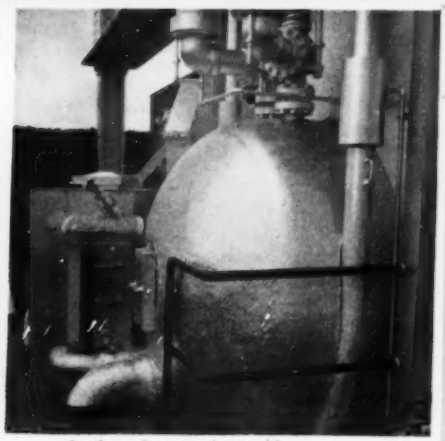


Lake Catherine Station of the Arkansas Power and Light Company.

All Units
Engineered By:
EBASCO SERVICES INC.



Foster Wheeler steam generator of the outdoor-type installed at the Arkansas Power and Light Company. Typical of those installed at Louisiana Power and Light Company, and Mississippi Power and Light Company.



Section of steam drum with external weatherproof covering protruding through water-tight, air-tight steam generator casing.

STEAM GENERATORS!

Foster Wheeler outdoor-type steam generators, each of 900,000 lb per hr capacity, now serving

Lake Catherine Station.....1 unit
ARKANSAS POWER AND LIGHT COMPANY

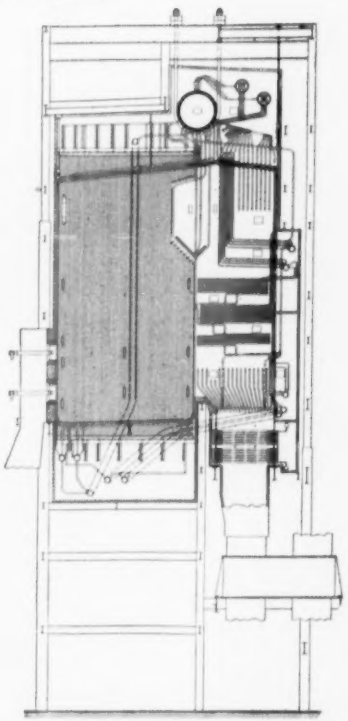
Ninemile Point Steam Electric Generating Station.....1 unit
LOUISIANA POWER & LIGHT COMPANY

Delta Steam Electric Station.....2 units
MISSISSIPPI POWER AND LIGHT COMPANY

Reflecting the wide acceptance of the outdoor-type steam generator, these four Foster Wheeler units are all serving power plants in the South. Because of the traditionally mild climate in these areas, the minimum of weather protection is required for personnel, steam generating units and auxiliaries. This same basic design has proved practical and economical in the Northern States, the only difference being in the extent of weather protection provided.

Each of these new steam generators has a capacity of 900,000 lb per hr continuously, and 950,000 lb per hr for an eight hour peak. Each delivers steam at 1550 psi and 1005F at the superheater outlet. A superheat control condenser maintains steam temperature constant over an operating range from 600,000 lb to 950,000 lb per hr.

Because of the proven economy and suitability of outdoor-type construction under a wide variety of climates, Foster Wheeler units, such as these, bring a new abundance of low-cost power to help promote the industrial growth of the regions they serve.



Cross-sectional elevation of the Foster Wheeler 900,000 lb per hr outdoor-type steam generator. Arrangement provides for modification of furnace for future pulverized coal firing.

The 145 ton drum of the Foster Wheeler outdoor-type steam generator being placed in position on structural steel framework at Lake Catherine Station.

FOSTER WHEELER

FOSTER WHEELER CORPORATION
165 Broadway, New York 6, N. Y.

For more data circle 526 on Post Card

ACCO products

CAST STEEL

PRESSURE CLASSES FROM 150 TO 2500 PSI

• R-P&C's cast steel valve line includes gate, globe, angle, swing check and lift check styles in a wide variety of sizes, pressure classes and body and trim materials. Typifying the quality construction of the entire cast steel line is the valve illustrated at left, the

fig. 1501—This popular OS&Y flanged end gate valve has a primary rating of 150 psi at 500° F. It is furnished in sizes from 1½" to 24". Construction features that lengthen valve life, lower maintenance requirements, include:

wedge and wedge guides—Solid I-beam type wedge for maximum resistance to distortion. Wedge guides, cast to true center of seating surfaces, guide wedge to a perfect seat—make contact only at point of closure.

seat rings—Bottom-seated type, of heavy uniform cross section. There are no points of high stress concentration. Broad seat contact and smooth finish give longer life, less wear. Port openings are full pipe diameter for lower pressure drop.

stainless steel trim—Regularly furnished with 12-14% chromium trim for greater corrosion resistance. Other trim materials, suitable for a wide variety of special services, furnished on request.

stem—Head forged integral engages wedge slot, provides self-alignment.

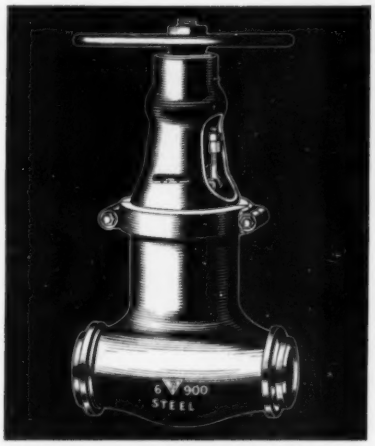
packing—Long fibers of 95% chrysotile asbestos are square braided and reinforced by wire insertions, lubricated with graphite and oil. This special packing produces tight joints at high temperatures and pressures, lowers stem friction, decreases maintenance requirements.

castings—All castings produced in R-P&C's own foundry under careful metallurgical controls. Conform fully to requirements of standardization societies and customers' specifications.

for further information on Fig. 1501 or other R-P&C cast steel valves, write for Catalog 9

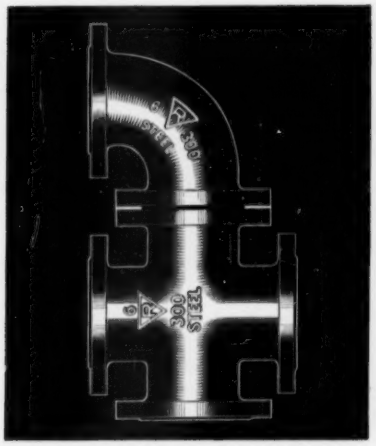
VALVES from 1½" to 24"!

FROM R-P&C's COMPLETE LINE



Pressure sealed bonnet joint cast steel valves are furnished in gate and globe valve styles in 900 lb., 1500 lb., and 2500 lb. pressure classes.

Bar stock valves are precision machined from highest quality bronze, carbon steel, or alloy steel bar stock. Working pressures for carbon steel range from 10,000 lbs. at 150°F to 475 lbs. at 1,000° F. Sizes from ⅛" to 1".



Cast steel fittings, ells, tees, laterals, crosses, reducers — screwed or flanged ends. Furnished in a wide variety of sizes up to 24", in pressure classes from 150 lbs. to 2500 lbs.

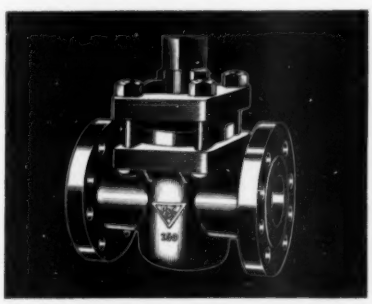
THE SECRET OF R-P&C's BETTER VALUES— QUALITY CONTROL

• A vital component of each R-P&C Valve is an ingredient you can't see. This hidden ingredient insures that you get the trouble-free operation and longer life engineered into each R-P&C design.

This hidden ingredient is called "quality control." It is a philosophy that dominates every step of the manufacturing operations that produce each R-P&C Valve.

Castings for every R-P&C Valve are produced in our own foundries under careful metallurgical controls. Casting soundness is verified by special radiographic techniques using radium or radioactive isotopes. Dimensional accuracy of each valve part is checked by a variety of gauging methods, including some specially developed by R-P&C engineers.

Before it leaves the factory, the performance of each valve is proved by individual hydrostatic and other tests. These tests are normally conducted at pressures higher than those for which the valves are rated.



Asbestos-packed cocks, an R-P&C exclusive, are furnished in iron in sizes from ¼" to 6" with screwed or flanged ends.

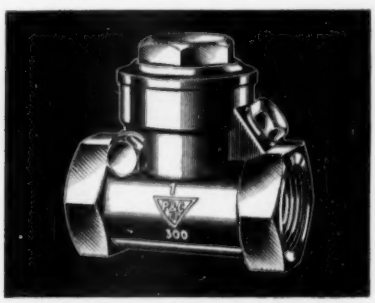


Fig. 212 screwed end bronze check valve typifies R-P&C's complete check valve line — furnished in iron, bronze or cast steel in sizes ranging from ¼" to 24".

WHICH OF THESE HELPFUL TECHNICAL AIDS DO YOU WANT?

R-P&C provides a wide variety of free technical aids to assist the buyer in valve selection, installation and operation. Among these are:

Valve Selector Slide Rule. Handy selector slide rule gives all dimensions for iron body valves, steel valves in 150, 300, 400, 600, 900 and 1500 lb. classes.

How To Select Valves. 17" by 11" wall chart lists principles to use in selecting valves for various applications . . . considers effects of fluids, temperatures, pressures, sizes, service requirements.

How To Protect Your Valves. 17" by 11" wall chart lists 22 installation and operation pointers to protect valves, get maximum life.

How To Know Valves. 17" x 11" wall chart graphically illustrates appearance, construction, operation, recommended applications for gate, globe and check valves, cocks.

Any of these free technical aids furnished promptly on request
Write R-P&C Valve Division, American Chain & Cable, Reading, Pennsylvania

ACCO

TRADE MARK

R-P&C Valve Division
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

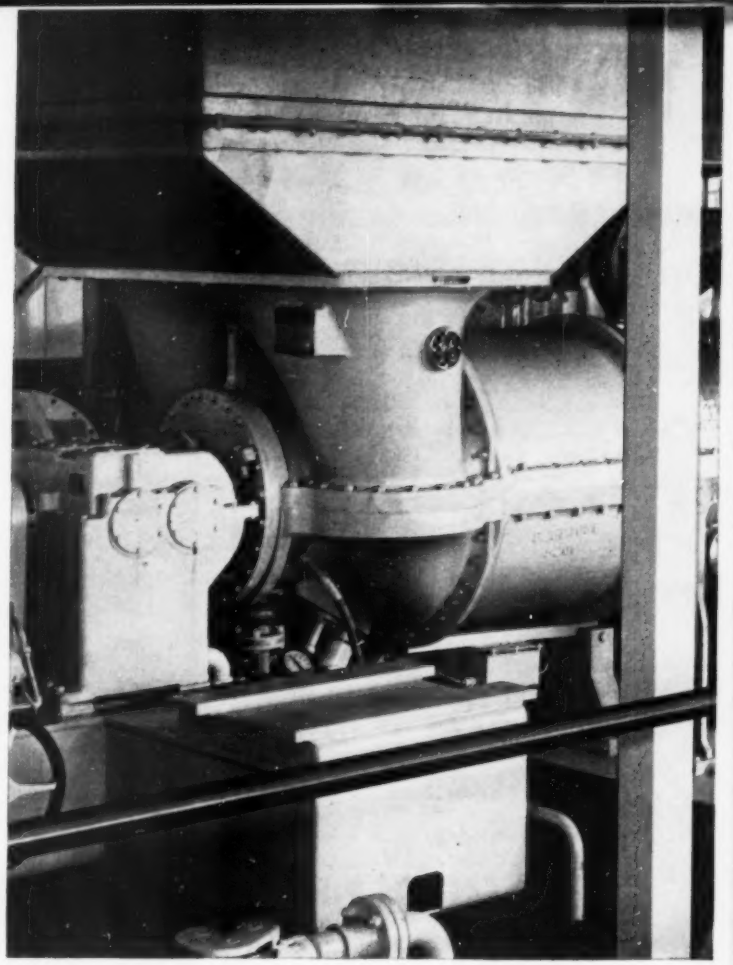
R-P&C valves

For more data circle 527 on Post Card

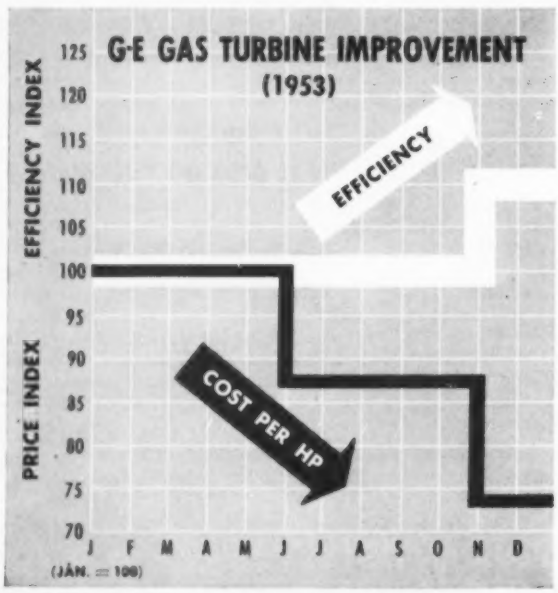
GAS TURBINE

progress report

In the past year, G-E engineers have reduced the cost per hp of the G-E gas turbine—and boosted its efficiency an average of 11 per cent. You may be able to put this versatile prime mover to work providing low-cost power for your plant.



Increased Efficiency, Versatility,



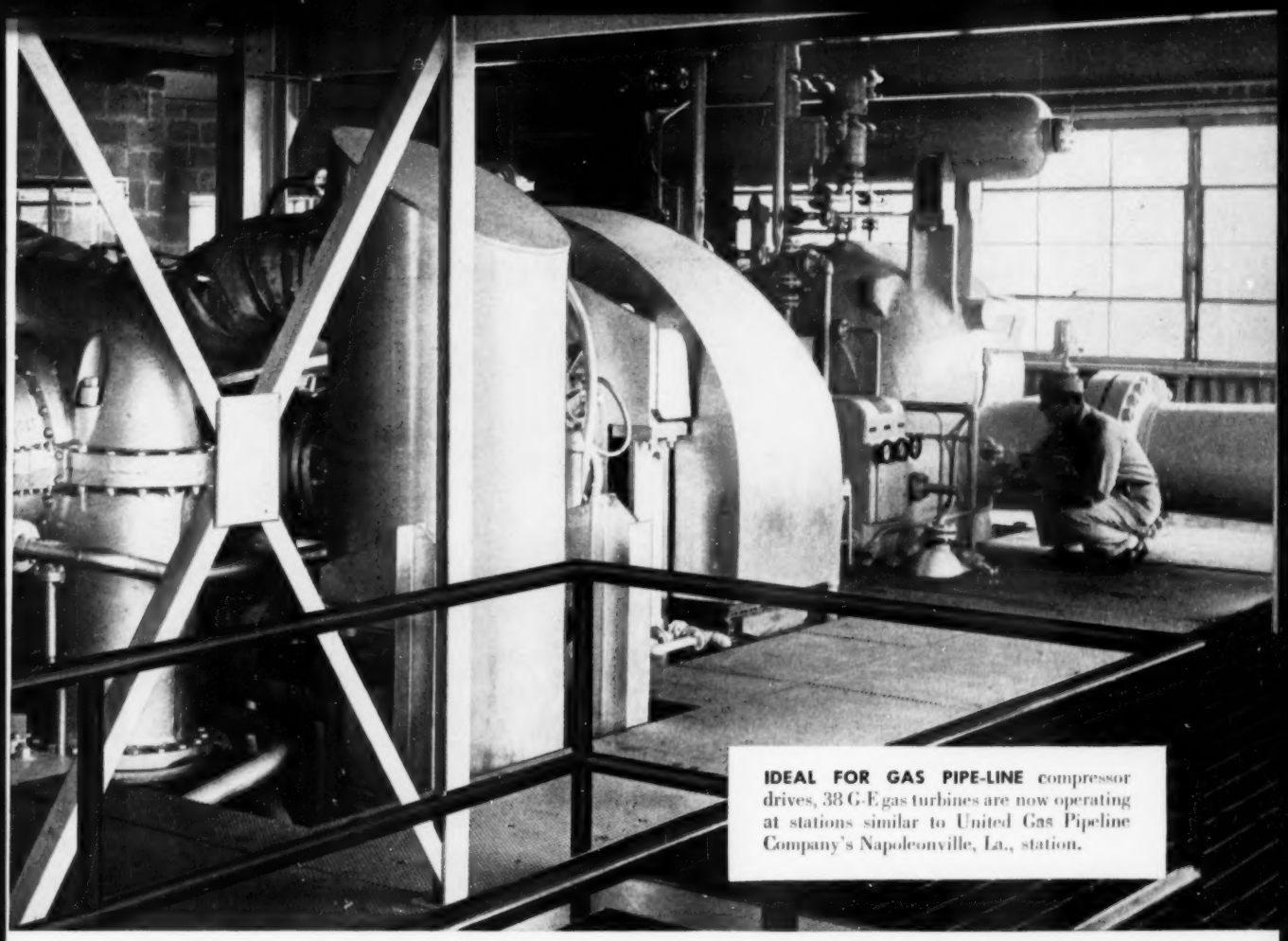
GREATER EFFICIENCY AND LOWER COST PER HP, achieved by improved design and manufacturing techniques, were significant G-E gas-turbine advances in 1953.

G-E GAS TURBINE OPERATING RECORD

(As of March 15, 1954)

TYPE OF SERVICE	NO. OF UNITS	OPERATING HOURS
LOCOMOTIVES	11	60,000
POWER GENERATION	16	70,000
GAS PIPE-LINE PUMPING	38	150,000
PETRO-CHEMICAL	1	3,000
TOTAL	66	283,000

UNEQUALED RECORD for operating hours and diversity of application, shows versatility and dependability of G-E gas turbine, gives G-E engineers vital data for future progress.



IDEAL FOR GAS PIPE-LINE compressor drives, 38 G-E gas turbines are now operating at stations similar to United Gas Pipeline Company's Napoleonville, La., station.

Lower Cost Per Horsepower Mark G-E Gas-turbine Progress

In less than five years, what was a completely new, un-tried prime mover has been shaped into a dependable, economical means of power. Already G-E gas turbines have racked up over 280,000 hours driving railroad locomotives, generating electric power, and turning high-speed compressors for gas pipe-line pumping and other industrial processes.

In the past year alone, G-E engineers have reduced the cost per horsepower for the gas turbines an average of 26 per cent. In the same short span, they have boosted efficiency an average of 11 per cent.

Outstanding among recent improvements is an integral base on which the turbine and its auxiliary equipment are permanently mounted and shipped—substantially reducing installation costs.

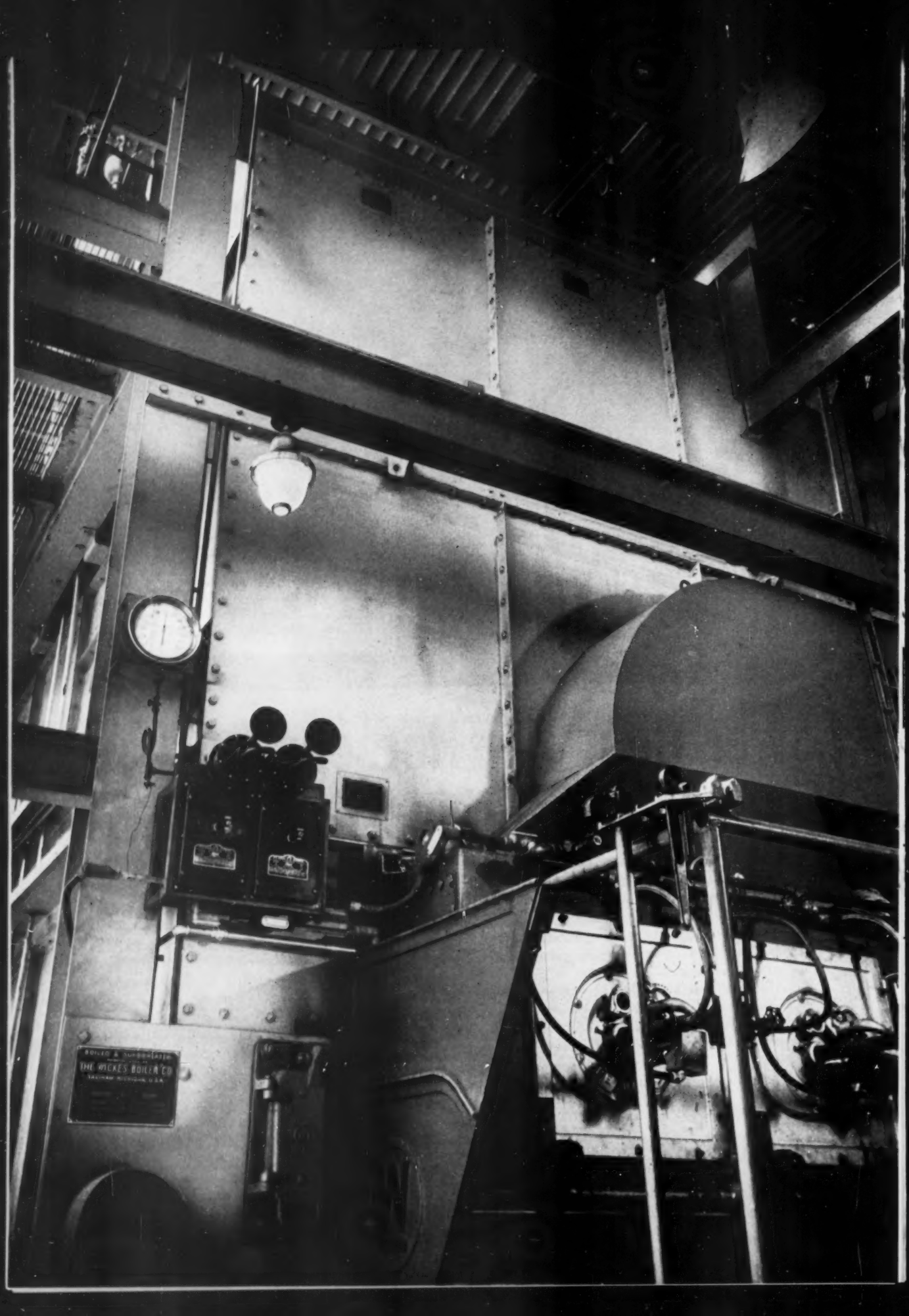
How could all this happen? General Electric, leader in the design and manufacture of both steam turbines and jet engines, was well equipped to develop the combustion gas turbine. Now, with thousands of hours of operating experience already accumulated, and with a factory designed exclusively for their manufacture, G.E. is leading the way in the gas turbine field.

If you would like more information on the gas turbine, contact your nearest G-E Apparatus Sales Office or write to General Electric Company, Section 255-10, Schenectady 5, New York.

Progress is our most important product

GENERAL ELECTRIC

For more data circle 528 on Post Card


THE WICKES BOILER CO

WICKES

3-drum boiler at KEELER BRASS COMPANY

Installation of a new 3-drum WICKES Water Tube Steam Generator has substantially increased operating efficiency at the Keeler Brass Company, Grand Rapids, Michigan, the world's largest manufacturer of furniture hardware. The new boiler, a combination oil-fired and underfeeder stoker unit, is capable of producing 40,000 lbs. of steam per hour at 350 psi.

WICKES will design and build water tube steam generators for any practical size and pressure. WICKES also offers a wide choice of auxiliary equipment so that it's possible for you to get not only the best steam generator, but also the best correlated equipment. Contact your nearest WICKES sales representative or write us today.

OUR 100th YEAR

THE WICKES BOILER CO.

DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN

RECOGNIZED QUALITY SINCE 1854 • **SALES OFFICES:** Albuquerque, N. M. • Boston • Buffalo • Charlotte, N. C. • Chicago • Cleveland • Dallas • Denver • Detroit • Fort Wayne, Ind. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Portland, Ore. • Saginaw • Salt Lake City • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D. C.

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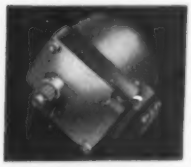
For more data circle 529 on Post Card

The "inside" story of *ElectroniK* instruments

Maybe you've never seen what's inside the case of an *ElectroniK* instrument. And even if you have, you might not realize how each component has been painstakingly refined to contribute its share to the overall performance and dependability of the instrument. Three of these components in particular—the converter, "Continuous Balance" amplifier and the balancing motor—are key members of the *ElectroniK* team with which you should get acquainted.

The Converter is what transforms tiny direct-current signals from the thermocouple or other sensing element into an alternating voltage that the amplifier can conveniently handle. In principle, it is somewhat like the vibrator in your automobile radio. But because it deals with such small bits of electrical energy, it has been designed of carefully selected materials which prevent the introduction of misleading signals into the measuring system. It is hermetically sealed against the effects of dust, humidity and atmospheric pressure change, and is shielded against stray electrical and magnetic fields.

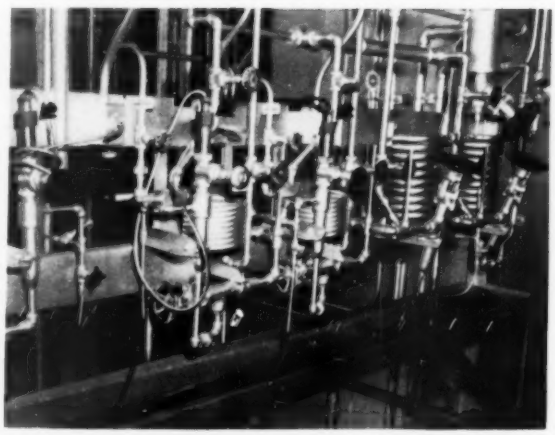
The "Continuous Balance Amplifier" boosts the incoming signals by millions of times . . . makes them strong enough to operate the balancing motor. Although it looks like part of a radio chassis, few communications circuits could equal it for quality. It uses standard, easily obtained parts, which are operated far below their normal ratings to insure exceptionally long life. The circuit has great stability against drift and pick-up, and is thoroughly temperature compensated.



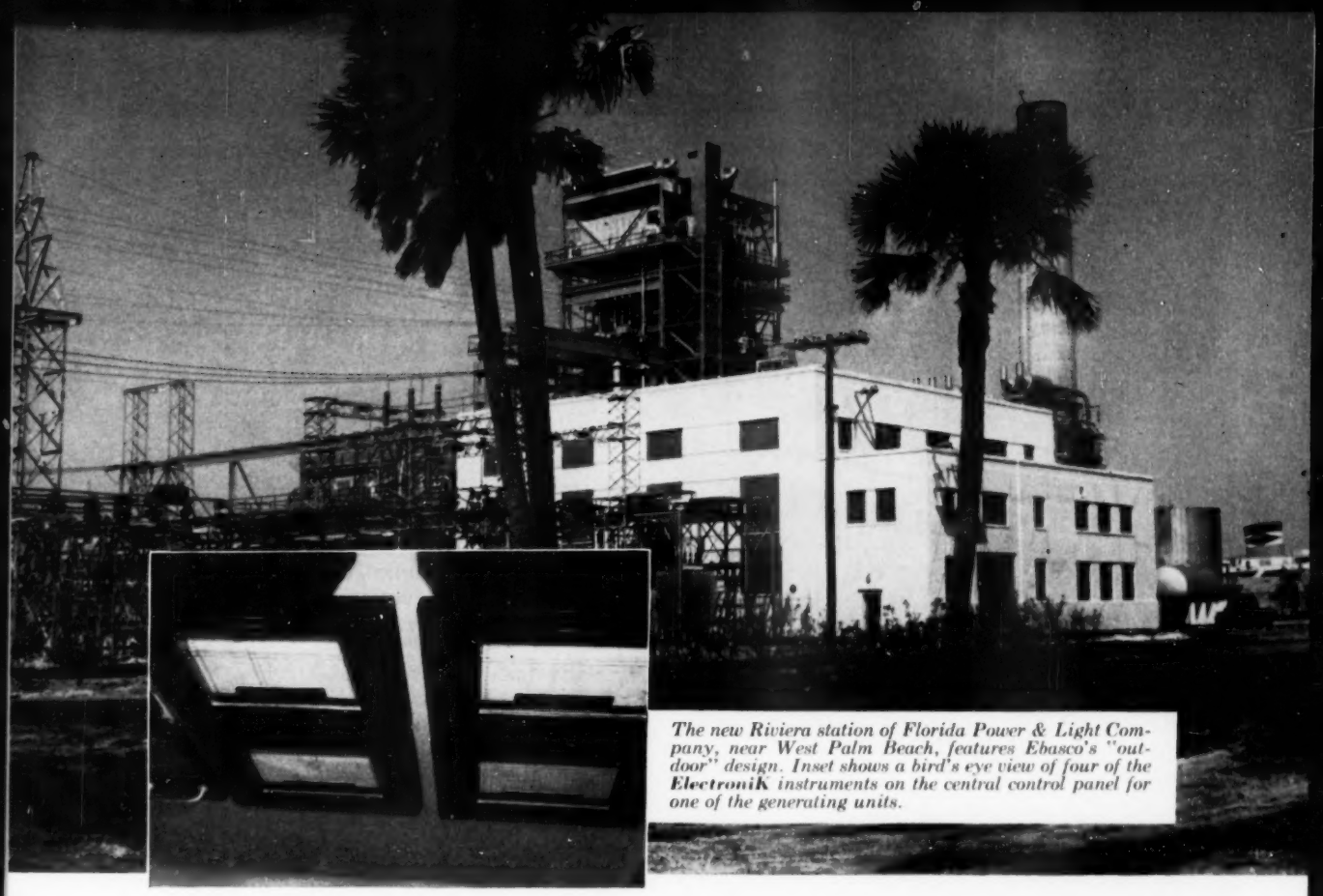
The Balancing Motor does the work of moving the pointer, recording pen and any control devices that may be incorporated in the instrument. It packs plenty of power into a small space . . . gives ample torque to give fast, accurate positioning whenever the amplifier calls on it. Totally enclosed, the motor is impervious to dust, dirt and changes in mounting position.

in *Florida* too!

New Ebasco-built station utilizes *ElectroniK* instruments to



Conductivity cells, mounted in sampling lines, are connected to an ***ElectroniK*** *instrument on the central control board, to measure conductivity of condensate, saturated steam and evaporator distillate.*



The new Riviera station of Florida Power & Light Company, near West Palm Beach, features Ebasco's "outdoor" design. Inset shows a bird's eye view of four of the ***ElectroniK*** *instruments on the central control panel for one of the generating units.*

record vital operating data

As modern as tomorrow is the new 131,000-kilowatt Riviera Station of Florida Power & Light Company, which helps to serve the power needs of a fast-growing part of the state. Designed and built by Ebasco Services, Inc., this station features efficient, centralized control . . . in which *ElectroniK* instruments have important responsibilities.

The varied uses which *ElectroniK* instruments fill on this plant's control boards demonstrate the outstanding versatility of these instruments. One of the instruments, for example, helps to safeguard boilers and turbines by recording conductivity of steam and condensate at selected points. Another watches over critical temperatures in bearings, boilers, steam headers, circulating water and other vital spots in the heat cycle. And as an accurate guide to generator loading, other *ElectroniK* instruments provide a continuous record of stator and rotor temperatures.

Brown instruments offer wide coverage of many of the most important points of measurement in modern steam plants, including pressure gages in varied ranges . . . liquid level systems applicable to open and closed vessels . . . pH recording and controlling systems . . . flow meters . . . and a full selection of *ElectroniK* instruments for measurement of frequency, power, reactive power, voltage, current and for telemetering. Both pneumatic and electrical transmission systems are supplied for remote measurement in centralized control designs.

Your nearby Honeywell sales engineer is well qualified to discuss the requirements of your own plant . . . and he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● **REFERENCE DATA:** Write for Bulletin 90-2, "Supervisory instruments for Power Generation."

MINNEAPOLIS **Honeywell**

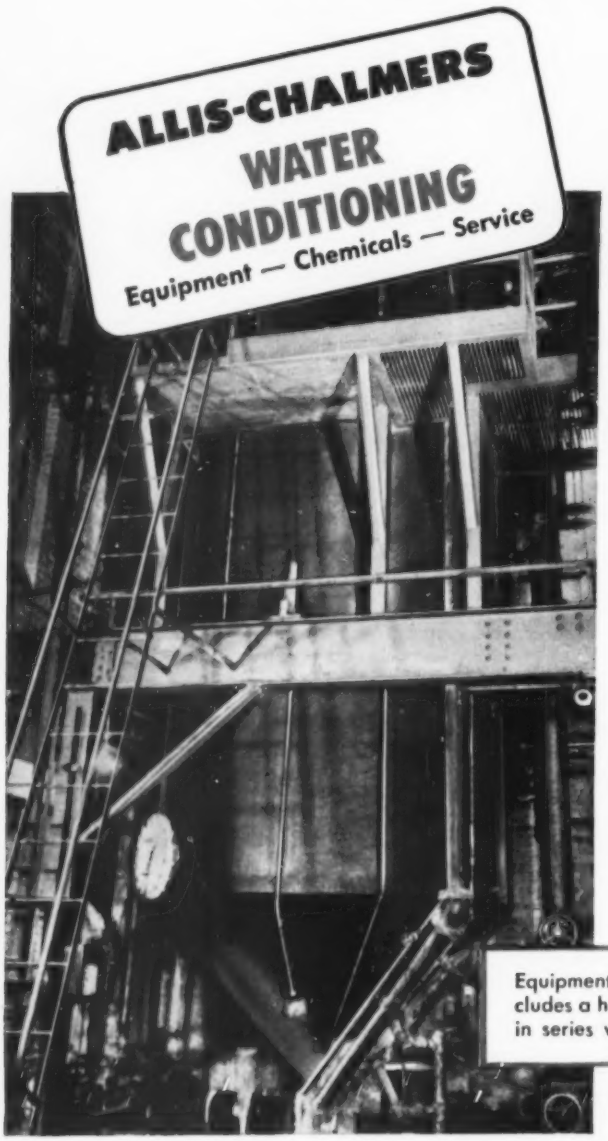
BROWN INSTRUMENTS

First in Controls

For more data circle 530 on Post Card

Minneapolis Gas Co., Minneapolis, Minn., Gets...

MORE BOILER FEEDWATER



How to increase feedwater supply without adding excessively to chemical and equipment costs? That was the problem at Minneapolis Gas Company, Minneapolis, Minn., when installation of new equipment increased demands on the power plant.

Allis-Chalmers water conditioning engineers solved this problem with a hot lime, ion exchange system that provides zero hardness, extremely low silica content, low alkalinity and low CO_2 in steam. Chemical costs are very reasonable, since only salt and lime are needed. An added dividend can come from the small amount of space required for equipment — for example, in one installation of this type, the resin tanks are tucked under the basement stairs.

Solve Any Water Problem

You can find a solution to any water conditioning problem by consulting with an Allis-Chalmers water conditioning expert. Allis-Chalmers will provide analysis and a complete recommendation, in addition to supplying you with the chemicals and equipment you need.

If you would like to learn more about the hot lime, ion exchange process outlined above, get a copy of Allis-Chalmers Water Conditioning Informational Bulletin 49 from your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4403

Equipment similar to this at Minneapolis Gas Co. includes a hot process lime-soda softener which is placed in series with the hot zeolite (ion exchange) unit.

ALLIS-CHALMERS

For more data circle 531 on Post Card

"You see POWELL VALVES everywhere!"

Naturally! Since Powell makes more kinds of valves—and has probably solved more valve problems—than any other organization in the world. And Powell Valves have a record of dependable flow control since 1846.

Just name the kind of precision valve you need—Powell can supply it. Made ⅛" to 30" and 125 pounds to 2500 pounds W.S.P. Bronze, iron, steel and corrosion resistant alloys. Available through distributors in principal cities. On problems, write direct to The Wm. Powell Company, Cincinnati 22, Ohio.

CONTROLS FOR THE LIFE LINES OF INDUSTRY

Powell Valves

108th year

For more data circle 532 on Post Card

Specification

for Saving Fuel

The fuel saved by the average system of Hagan Automatic Combustion Control pays back the initial investment within the first year of operation. Comparable savings continue as long as the boilers last. This is a clear profit, amounting to many times the price of the Hagan Automatic Combustion Control.

The indications and records of Hagan Ring Balance Instruments provide the operators with the performance picture necessary for maintaining top efficiencies.

The design and construction of all components stress durability, accuracy and versatility. There is a system of Hagan Automatic Combustion Control and Ring Balance Instrumentation for every boiler plant, with any number or size of boilers, operating at any steam pressure and temperature, and burning all types of fuels, singly or in multiple.

Hagan methods and Hagan equipment are also operating successfully in such applications as:

- Boiler drum water level control, with automatic set point adjustments available.
- Superheated steam temperature control.
- Steam pressure reduction and spillover control.
- Draft or pressure control over a continuous range from fractions of an inch water column to 5000 psig.
- Feedwater heater pressure or temperature control.
- Recording, indicating and integrating flows of water, steam, liquid and gaseous fuels.
- Simultaneous records of two separate flows, measured in a single meter housing.
- Pressure and temperature compensated records of steam and gas flows.
- Density compensated records of boiler drum water level.
- Pneumatic and electric signal transmission for remote recording.

For modernization or extension of existing installations, or for new construction, our engineers will be glad to suggest the best system to fulfill your requirements.

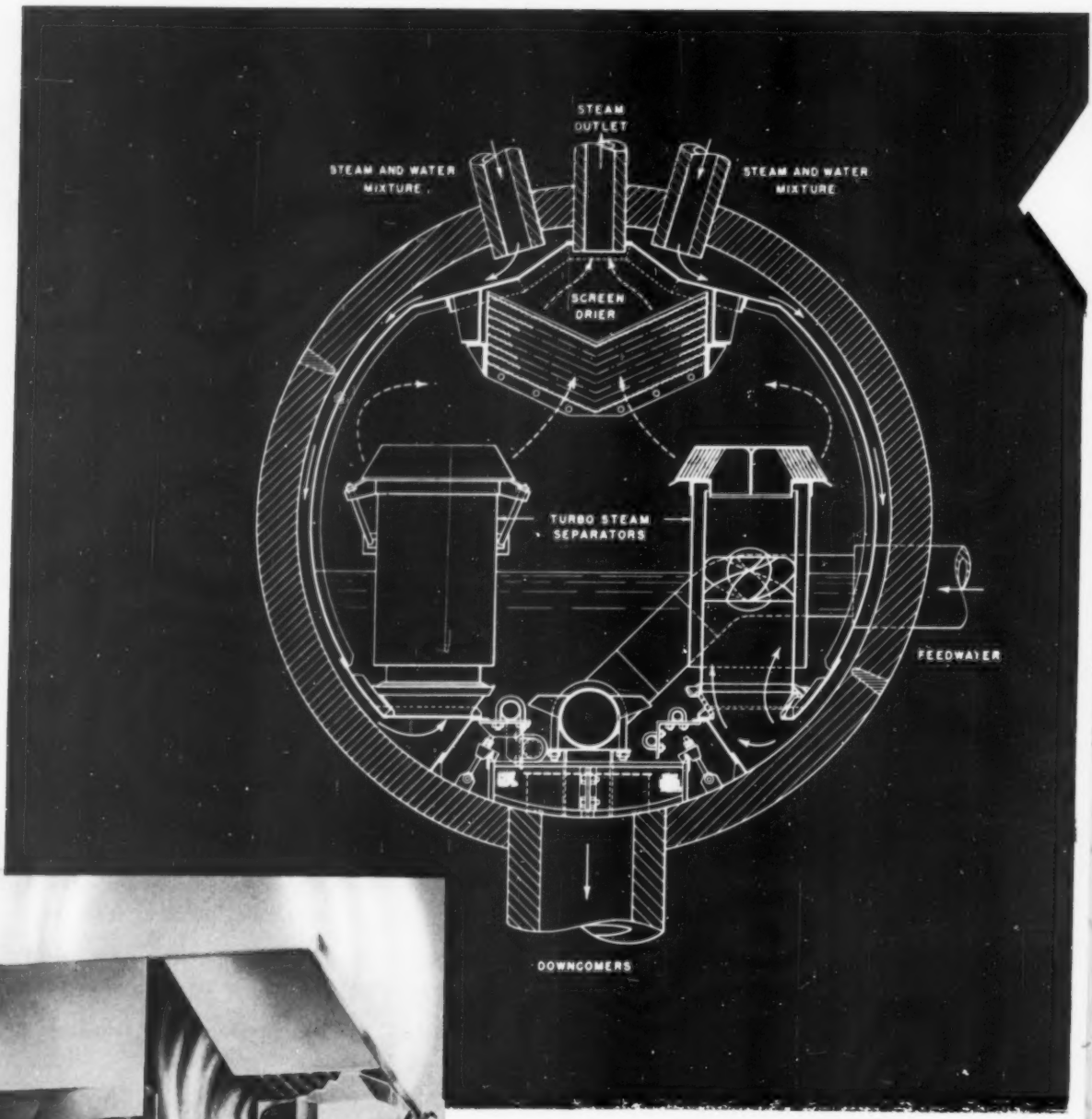
HAGAN CORPORATION

HAGAN HALL BUROMIN CALGON

HAGAN BUILDING • PITTSBURGH 30, PENNSYLVANIA

Boiler Combustion Control Systems • Ring Balance Flow and Pressure Instruments • Metallurgical Furnace Control Systems • Control Systems for Automatic and Aeronautical Testing Facilities

For more data circle 533 on Post Card



How it works

Steam-water mixture enters the top of the drum through nozzles discharging into an annular space formed by internal baffles. Flow of the mixture is directed downward behind symmetrical baffles around the entire drum surface, maintaining a uniform drum-wall temperature, and then into the Turbo-Separators. The latter contain a center core and vanes which give the mixture a spinning or centrifugal motion, thereby throwing the water to the outer edges of the inner tube. Directly above the directional vanes and cores there is a skim-off lip which directs the water over the top of the inner tube and thence through the annular space to the drum. This is the primary separation stage. The relatively dry steam then passes through two opposed banks of closely spaced corrugated plates, which change the direction of the steam many times and throw out much of the remaining water. This is the secondary separation stage. The third and final stage of purification is accomplished in the screen dryer.

MEET THE TURBO-SEPARATOR

. . . the best friend a turbine ever had

To anyone concerned with the subject of steam purity and quality, boiler drum internals are of great significance. For that reason, we would like to have you meet the C-E Turbo-Separator, long an integral part of C-E Utility Boilers, but normally well concealed from view within the dark recesses of the steam drum.

The true test of any system of drum internals lies in what it can do with the combination of water, steam and solids it must handle — not alone under steady base load conditions — but under all operating conditions. Sudden load fluctuations, change in boiler water level and increased solids concentration in boiler water due to condenser leakage are three common occurrences that can greatly affect the relationship of solids to steam.

Whether the concentration of solids in boiler water averages less than 100 ppm or even more than 1000 ppm — or whether it fluctuates anywhere between — the C-E Turbo-Separator *maintains* steam purity and quality well within satisfactory limits.

To be more specific — test results in a number of cases have shown less than .5 ppm and in some instances as low as .1 ppm. These results are supported by the fact that in no plant where Turbo-Separators are installed has there been any measurable loss of turbine capacity due to deposits on turbine blades.

When you add the proven advantages of C-E Turbo-Separators to the operating characteristics of modern designs of C-E Utility Boilers, you have the right combination for top year-around plant performance on all counts — efficiency, capacity and continuity of service. B-758

COMBUSTION ENGINEERING

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS, AUTOMATIC WATER HEATERS; SOIL PIPE

For more data circle 534 on Post Card

EQUIPMENT NEWS

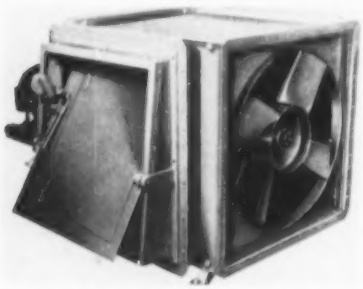
Described here are new and newly improved products. Use the Reader Service Cards on page 107 to ask for more information on them. Just circle item numbers of all the products in which you are interested.

1—METERING OUTFITS have ratio changing arrangement

These metering outfits are equipped with a ratio changing arrangement for de-energized operation with an outside handle that can be operated from the ground level. This arrangement is designed for easy and safe operation, in substation yards. The ratio changer has self-aligning contacts with equal and positive pressure, and round point contact against flat stationary contact establishes only one current path. These metering outfits are available for current ratings up to 200/400 amp 25 kv through 69 kv. Allis-Chalmers Mfg. Co.

2—DRAFT INDUCER redesigned for loads to 100,000 lb per hr

This newly designed furnace draft inducer, with capacity range to loads of 100,000 lb per hr, has many new features. Interchangeable side panels permit easy adaptation to installation requirements for gas inlet and outlet openings. The four side panels surrounding the motor-fan may be unbolted and shifted as desired. A barometric damper may be used replacing one of the side panels. Moveable mounting feet allow for four different mounting positions. Other new features are: motor and fan assembly completely withdrawable; spring-



mounted motor and V-belt drive to prevent misalignment; variable speed motor for precise draft control, and pre-sealed bearings. It is pointed out that the unit is compact and can be manipulated in the often limited space at the stack breeching, since only the casing need be handled. L. J. Wing Mfg. Co.

3—SOLENOID VALVE provides automatic flow control

Designed to give automatic "on and off" control of flow (water or air), a new piston-type, pilot-action solenoid-operated valve is available in $^{3}/_{8}$-, $^{3}/_{4}$-, and $1\,^{1}/_{4}$-in. pipe sizes. Called the Electroflo Valve, it is designed to permit flow only during required periods. Its pilot action provides large flow capacity, manufacturer points out, and it has an "anti-water hammer" feature. It is packless, has non-corrosive parts. Hays Mfg. Co.

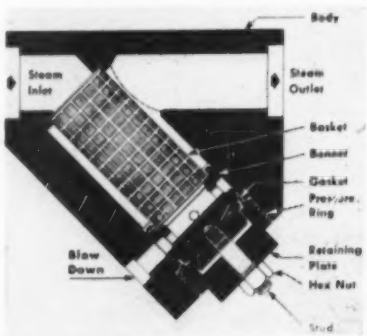
4—PRESSURE CONTROLLER for pressure-vacuum systems

The Type 1440 Pressure Controller (non-recording) for sensitive pressure-vacuum control systems is designed to handle both positive and negative pressures — from high vacuum to 10,000 lb. Described as an instrument of high accuracy, this controller is Bourdon tube actuated. Proportional band and on-off or maximum-minimum snap action adjustment is made without additional parts. Either action may be adjusted to pressures up to 75 per cent of the limits of the Bourdon tube rating. Having an aluminum case, the Type 1440 is compact (8 by 4 in.), has door hinges to left or right, straight line piping. Black, Sivalls & Bryson, Inc.

5—STRAINER for high pressure steam, boiler feed service

For steam and boiler feed pressures above 900 lb, the SK Fig. 994-HP Strainer incorporates, in a forged steel or forged alloy body, a new "pressure seal" bonnet construction. The use of the pressure seal principle — the greater the pressure, the more secure the seal — besides making a pressure leak improbable, is said to eliminate the use of bulky covers and large fastenings.

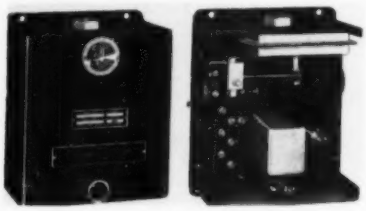
Gaskets utilized in this new strainer are designed to provide a satisfactory seal at high operating temperatures. And to further add to the compactness



of the unit, the blowdown connection has been brought through the side of the strainer wall. It is pointed out that this design feature means no piping need be broken when removing the cover and strainer basket from the body for maintenance, checking or replacement, a factor of particular importance at high pressures and temperatures where pipe joints are usually welded. Bulletin 9S-HP gives additional information. Schutte and Koerting Co.

6—LOW-DRAFT CUT-OFF for protection of boilers

The Lo-Draft Cut-off is designed to protect boilers in the event of mechanical or natural draft failures, and to prevent nuisance shutdowns caused by momentary puffs. It is declared suitable for all firing methods and boiler types. This control also activates remote alarm systems or signal lights and its cut-off point can be adjusted on the job over a wide range. A signal light or alarm indicates momentary low-draft burner puffs, as well as sustained low-draft conditions. But a time delay device, self-compensating for ambient temperature, serves to prevent unnecessary burner stoppage



due to transient conditions. Installation may be either at combustion chamber or at breeching.

The switch is designed so that the tube controlling cut-off delay operates more quickly in the warming up period than after the unit has been operating for some time. This is said to provide supersensitive response during light-off of the burner, and less sensitive control after it has fired up. The control is available in the Model LDT-A for interruption of low voltage burner control circuit, and the Model LDR-A for line voltage interruption. A plug-in relay can adapt the former for line voltage use. Terminals are for wiring to 115 or 230 v a-c. Cleveland Fuel Equipment Co.

7—PUMPS, high efficiency, for draining cellars and pits

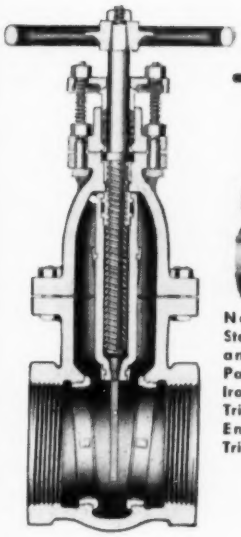
Two new automatic pumps for emptying water out of basements, elevator and boiler pits are announced. The standard Type DSM is driven by a $^{1}/_{3}$ hp, 115-v 60-cycle single-phase NEMA motor actuated by non-corrosive displacer bobs which are adjustable on a stainless steel wire. Except for its stainless steel shaft, this entire pump, including support columns, is made of bronze.

The Type DSS is an entirely submersible unit with motor encased in a stainless steel shell that also serves as an adjustable float control. Both pumps use bottom suction for maximum drainage, semi-open non-clogging type impellers. The pumps are designed to handle from 180 gph against 24 ft head and 3700 gph against 6 ft heads. Aurora Pump Co.

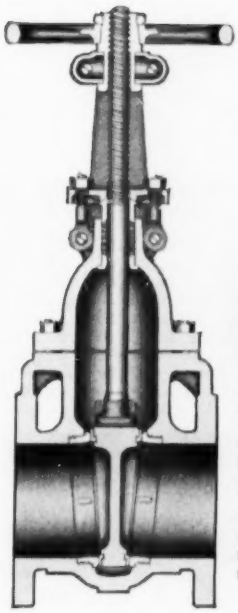
8—KNIFE PIPE CUTTERS designed for hand or power use

Automatic knife pipe cutters for hand or power use are available for cutting, beveling for weldments or grooving for com-

Crane 125-Pound Iron Body Wedge Gate Valves are an improved design, embodying many features of unusual merit. They set a new peak for quality in iron body wedge gate valves, having greater strength, longer life, and better all-round adaptability for all types of services.



Non-Rising Stem; Screwed and Flanged Patterns; All-Iron or Brass Trimmed. Hub Ends, Brass Trimmed only.



Outside Screw and Yoke; Screwed and Flanged Patterns; All-Iron or Brass Trimmed. Also available with brass seats and steel stem.

See If You Don't Agree!

Here's the big value—the big selection: CRANE 125-Pound Iron Body Wedge Gates

. . . with quality features that assure exactly the kind of service you want. Body and bonnet are oval-shaped with extra metal where it's needed most, to provide liberal strength. Flanged patterns have tie-ribs between body and bonnet flanges. You also get a solid web-type disc with long guides . . . a stem of liberal diameter with long thread engagement . . . an exceptionally deep stuffing box with high-grade packing . . . a two-piece ball-type gland and flange—plus an easy-to-grip handwheel with oval-shaped rim. Non-rising stem valves have a brass bushed stem collar. OS&Y design includes a brass bonnet bushing, swinging eye bolts . . . and a tee-head disc-stem connection on sizes 12-inch and smaller.

Big selection includes all-iron or brass trimmed valves . . . Underwriters' pattern valves, quick-opening types . . . valves for process industries . . . valves for marine service. Sizes up to 48-inch. Check your Crane Catalog or ask your Crane Representative next time he calls.

THE BETTER QUALITY . . . BIGGER VALUE LINE . . . IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

For more data circle 535 on Post Card

press on type joints, and for cutting Saran lined pipe. They can be quickly changed for the various operations. The knives have manufacturer's "Safety-Depth Guide" ahead of the cutting edge to prevent "hogging in" and knife breakage. Made for use with several of manufacturer's geared cutters, ⅛ to 12 in., plus pipe machines, ½ to 2 in., the knives are designed to cut pipe without leaving burrs; make weldments, victualic joints. Beaver Pipe Tools, Inc.

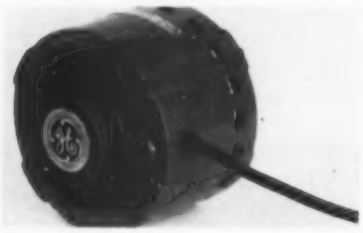
9—SELF-STICKING MARKERS for pipes as hot as 300 F

According to manufacturer, All-Temperature Pipe Markers stick without moistening — and stay stuck — to bare or insulated pipes at continuous temperatures from −300 to 300 F. And besides their ability to "beat the heat," these markers have twice the adhesion (32 oz as compared to 16 oz per inch of width) as company's previous markers. They conform to ASA standards, carry

the name of the material in the pipe in black letters on the proper background color. And they're mounted on handy dispenser cards treated with a release coating that lets you pull the marker off quickly and without distortion. A sample is offered. W. H. Brady Co.

10—FHP MOTOR for heavier duty, greater efficiency

Type KSP-39, a 5½-in. diam shaded-pole motor designed for heavier duty at increased efficiency and low input current, has been added to the company's line of smaller shaded-pole motors, with ratings of 1.5 w to 1/10 hp. It is available in ratings of 1/12, 1/10, ⅛ and 1/6 hp, for use on room air conditioners, furnace fans, unit heaters and coolers



and general application. Optional features include internal baffling, single- and double-shaft models, and resilient-base, cushion-ring or shaft-end mounting. General Electric Co.

11—CONTROL VALVES for pressures to 6000 psi

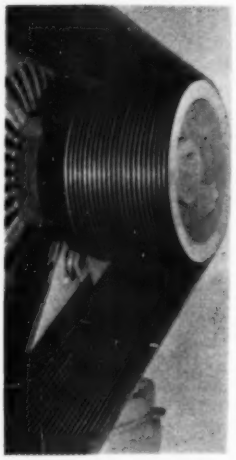
Newest addition to this company's line of high pressure control valves is the Series 34 for pressures to 6000 psi and temperatures to 900 F. Motor-, cylinder-, and manually-operated models are available, and the valves are furnished in ½- and ¾-in. sizes in both offset globe and angle bodies. The Annin Co.

12—V-BELT DRIVE offers increased horse-power, longer service

The belt, utilized in the Poly-V Drive is a single, endless rubber belt with a series of parallel V ribs molded lengthwise around the inside circumference; it has an uninterrupted high-strength member of synthetic cords across its entire width. The sheave grooves are designed to mate with the belt ribs, and since the belt covers the full width of the drive member (not an assembly of several V-belts), the load is distributed equally.

It is explained that this provides twice the contact area of a comparable multiple V-belt application, so that the Poly-V Drive gives up to 50 per cent more horsepower with same width, or equal horsepower with ⅓ less sheave width. It is noted that design features of the drive reduce face pressure on half, giving longer life to belt and sheaves, and the full drive width and total traction surface contact serve to prevent belt turnover and progressive sinking in sheave grooves.

An important feature of the new drive is that it eliminates belt matching problems and affords marked economy in belt and shave inventories. It is available in two cross sections: No. 187 for applications where A, B, or C section multiple V-belts would be used, and No. 375 for those where C, D and E sections would be used. Manhattan Rubber Div., Raybestos-Manhattan, Inc.



13—FLOCCULATOR for water treatment plants

The Spirol-Mix Flocculator is designed for vertical mounting in the flocculation basin. Water entering at the bottom is gently roll-mixed as it passes upward through the basin to the outlet at the top. According to manufacturer, the Spirol-Mix: eliminates short-circuiting of flow which wastes chemicals and lengthens settling time; provides a decreasing rate of agitation as floc forms while rising in the basin, thus preventing a break-up of floc already formed; and produces a uniform roll-mix action in the same direction as the water flow.

The unit consists of a variable-speed drive mechanism mounted on top of the basin and connected by a flexible coupling to a paddle-type mixer assembly within the basin. The mixer assembly consists of a vertical drive shaft to which blade support arms are attached. Load and thrust of the assembly is taken up by thrust bearings in the drive mechanism, and the drive shaft is held in place at the bottom of the basin by a pressure, water-lubricated guide bearing.

The pitch of each set of diagonal blades is increased toward the central axis to create a propeller-like action and provide a uniform multi-swirling motion. The step arrangement of each set of blades results in a decrease in total blade area from bottom to top of basin — as the water rises it is subjected to a decreased rate of agitation to prevent destruction of the floc formed earlier. Graver Water Conditioning Co.

14—PORTABLE CABINETS for small parts; visible drawers

Portable models have been added to this company's line of See-Thru Cabinets for small parts. Suggested for servicemen and repairmen, these welded steel cabinets have non-slip handles. Small parts and supplies can be neatly filed in the clear plastic drawers. One model, the JC-32-SD has 24 plastic drawers, each 1 7/16 in. high by 2¾ in. wide by 5⅞ in. deep, and one large steel drawer, 3⅛ in. high by 11½ in. wide by 5⅞ in. deep. The cabinet is finished in gray and has rubber feet; it is priced at less than $16.00. This and other portable models are reported to carry a 100-lb load safely. General Industrial Co.

15—STRIP CHART RECORDERS note 10 and 20 points

Two electronic strip chart recording instruments have been designed to record 10 and 20 points. Manufacturer says that 20-point recorders yield 25 per cent more data than 16-point models, without a proportionate increase in size or maintenance expense. They are declared particularly suited for installation in the power and utility industries where a quantity of information is required, but where measurement is limited by cost or space considerations. More information is contained in Specification Sheet 165.1. Industrial Div., Minneapolis-Honeywell Regulator Co.

16—TUBULAR HEAT EXCHANGERS for cooling liquids, gases

FC Coolers, a new line of tubular heat exchangers, assembled of standard parts, are said to offer the benefits of a specially designed unit and the advantages of mass production — low initial cost, quick delivery and available replacement parts. They are offered in various combinations of ferrous and non-ferrous materials, built to comply with ASME Code. Doyle & Roth Mfg. Co., Inc.

17—CABLE CLAMP, fiber glass cloth; saves cost, space

A line of flexible, loop-type cable clamps of laminated fiber glass cloth and polyester resins is announced. As the fiber glass plastic is a non-conductor, clamps

require no insulation and are recommended by manufacturer for construction, maintenance, power generation, industries using cable or heavy wire.

These clamps which are made of Hess, Goldsmith glass cloth and polyester resins, do not support combustion, have a high heat resistance and are fungus-proof and non-corrosive. Their flexi-

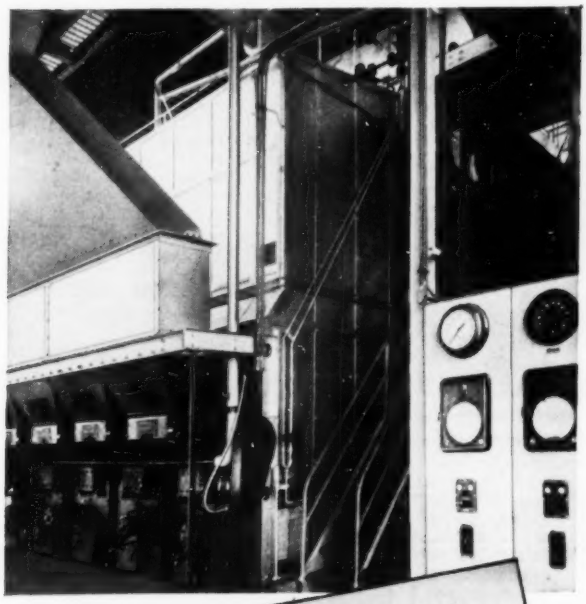
"HOW WE SAVE MORE THAN $90,000 A YEAR—

BY BURNING COAL THE MODERN WAY!"

says W. H. FISHER, Plant Engineer, Kerr Bleaching and Finishing Works, Concord, North Carolina.

"Powering our plant used to take nine boilers—now *one* does the same job *using 30% less fuel!* 6 firemen now do the work of 18—thanks to modern coal-handling equipment and automatic controls. That's why we say, you can't beat bituminous coal burned with modern equipment."

Above is a view of the plant's modern, space-saving coal-storage silo. To the left is a close-up of the firing aisle, showing the spreader stoker and the main control panel. Coal handling is automatic and dust-tight throughout. Automatic controls regulate firing, drafts and feed-water—give maximum efficiency at lowest cost.



If you operate your own steam plant, you can't afford to ignore these few down-to-earth facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U. S. A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

Burning coal the modern way can save *you* money, too! First, labor costs can be cut to a minimum with up-to-date coal- and ash-handling equipment. On top of that, today's combustion installations give you 10 to 40% more power from each ton of coal than was possible a few years ago!

If you're planning to modernize, or if you're building a new plant, call in a consulting engineer. He'll show you how you can get big savings by burning coal in a modern plant designed to meet your *specific* needs.

America's coal reserves are virtually inexhaustible; America's coal industry is the world's most productive and efficient. That's why coal has a future dependability of supply that no other fuel can offer. That's why, of all fuels, the price of coal is most likely to remain stable.

BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

For more data circle 536 on Post Card

bility is said to give them greater fatigue resistance even when subjected to continuous vibration and lengthens service life. Other advantages cited are faster installation, and less wear on cable insulation than unprotected metal clamps. They are available in sizes from 0.125 in. diam loop to 2-in. diam. Le Conte Plastics Co., Inc.

18—BACKING RINGS, of ceramic material, for pipe welding

New ceramic backing rings are announced as easily removable when weld is complete, and adaptable for both field and shop fabrication. The rings form smooth uniform light beads inside the pipe, says manufacturer, their grooves preventing excessive penetration and icicles, since the welding arc cannot burn through the ceramic material. The resultant weld is described as smooth and uniform, with a slight concave shape that serves to provide maximum strength and minimum flow resistance.

The rings are credited with reducing test failures, speeding welding operations, lowering fabrication costs. Rings with reusable positioner pins serve to center ring and act as root spacers while tacking joints. They come in several sizes. Chemical Equipment Div., General Ceramics Corp.

19—COLLOIDAL FORMULAS for cleaning boilers, condensers

When added to boiler waters of various types, the new Series 31-H Formulas are reported to dissolve all forms of scale and corrosion and oil and grease, and to hold the resulting particles in suspension for removal by blowdown. Mud and sludge are carried off by this method rather than deposited, it is explained, and normal operation is not disturbed. Tests are said to show that most boilers can be cleaned in 30 to 40 days.

Cleaning action extends beyond the boiler also, it is pointed out, because the formulas blend with the boiler water and clean wherever it or the steam travels, including the entire steam side and system and back through the condenser. Cleaning costs are said to be low. Water Treatment Co. of America.

21—SECURING RIG for quick anchoring of guy wires

Besides permitting easy anchoring of guy wires and cables, the Tyzem Securing Rig has a spring arrangement designed to provide automatic control of tension and assure uniform cable tightness. Essentially, this rig consists of an adjuster mechanism and tension-controlling compression spring. The free end of a guy wire or cable is passed through a locking mechanism attached to the tensioning spring. The cable is then pulled through until the spring compresses fully, then released to open the spring slightly. The locking lever is snapped into a safety lock keeper.

The Tyzem grips the cable anywhere without kinking or damaging, says company, and the entire rig will develop over 90 per cent of the breaking strength of the cable. Parts are corrosion resistant. Eastern Rotorcraft Corp.

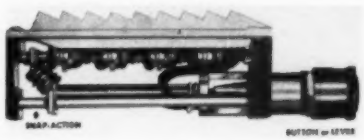
22—20-AMP TROLLEYS for busway electrification systems

Four new 20-amp special service trolleys are offered for this company's "60" trolley busway electrification systems in which service is continuous or where capacity higher than provided by standard "60" trolley is necessary. The extra capacity afforded by these trolleys is declared particularly advantageous in budget hoists, low tonnage cranes, portable and machine tools where motors to 3 hp can now be powered without trolley overload. Feedrail Corp.

23—DOUBLE THROW SWITCH controls eight primary circuits

All you have to do to operate this eight-pole double throw switch is push a button or throw a lever, says manufacturer — whereupon this over-riding master unit switches on or disconnects eight primary circuits for control of multiple machine operations. It may be applied to stop carriers; release machine loads; stop or start machines; shut off boiler feeds; dump fuel, or start extinguishers.

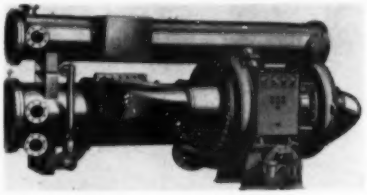
Constant contact pressure (4 oz per point) is said to be maintained throughout the stroke until snap-action occurs in either direction; there is no dead center. The contacts handle 5 amp 28 v d-c inductive; 10 amp 115 v d-c non-inductive; 60 to 400 cycles. The switch is



claimed to exceed resist shock and vibration and to operate at −65 to 160 F. Designed for easy multiple wiring to each terminal, the unit mounts on $1\frac{1}{2}$ by $1\frac{1}{4}$ in. panel area and weighs about 8 oz. It is available with auxiliary "push-to-test" SPDT circuit and dial light. Guardian Electric Mfg. Co.

24—WATER CHILLERS for comfort or process air conditioning

With the addition of these three new larger sizes, this company's line of CenTra Vac Water Chillers now includes eight sizes from 45 to 400 ton capacity. CenTraVacs incorporate a hermetic centrifugal compressor that automatically matches power consumption to



load variations from 100 per cent to 10 per cent of compressor capacity, says manufacturer. Power input is limited to actual cooling requirements, thus reducing power costs. CenTraVacs are designed to start, stop and run automatically with controls interlocked for safety. They can be installed without special bases. Bulletin DS 399 describes these water chillers. The Trane Co.

25—ROOF VALVE aids in fighting fire; releases smoke, gases

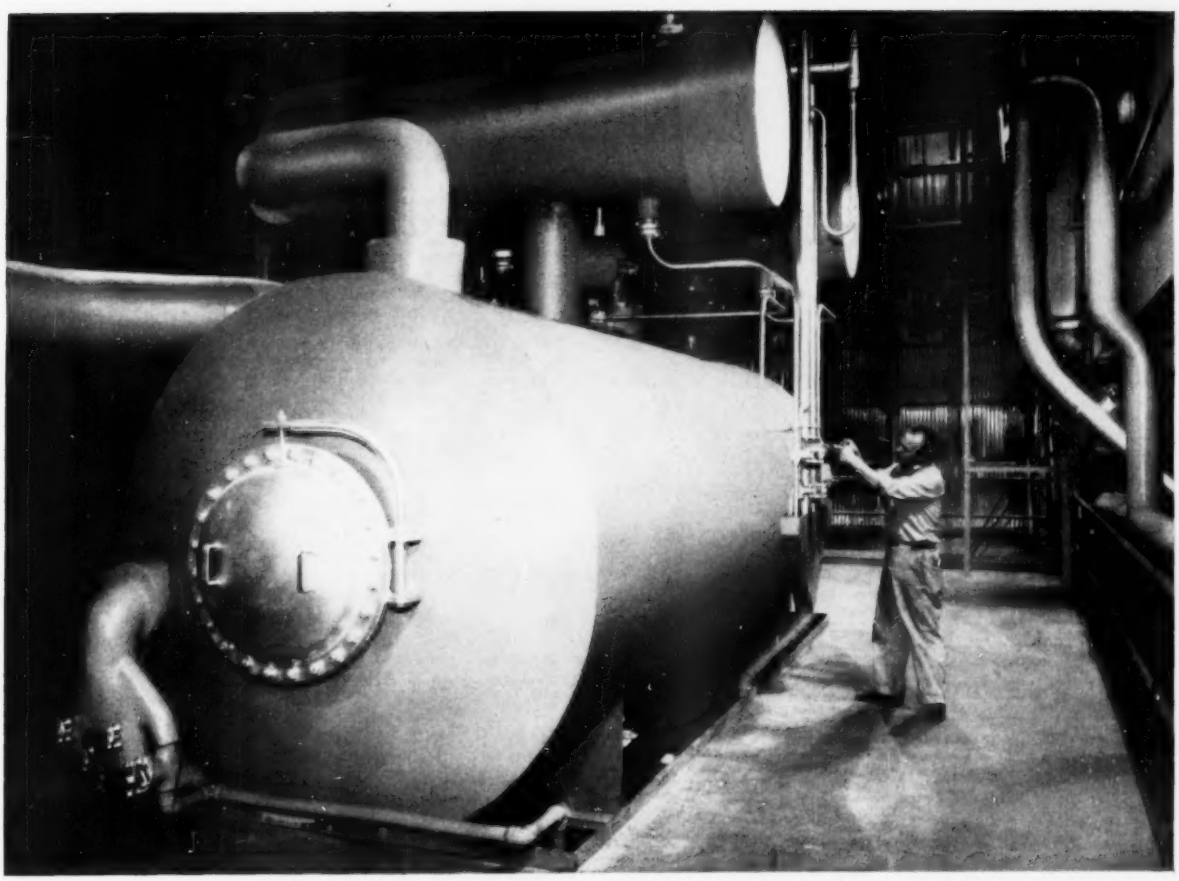
The Fire Valve, a roof unit for buildings, is designed to open quickly when excess interior heat occurs. Developed for fast release of heat, gases and smoke in the event of fire, each unit provides 46 sq ft of free area opening when two large dampers drop, released by a fusible link device. Dampers can also be opened and closed by a loop chain when it is desirable to use the unit for extra ventilation. The Fire Valve is weatherproof when closed, it is noted, and any number can be installed on a roof. A bulletin gives data on it. The Swartwout Co.

20—SERVICE WEDGE CLAMP helps to reduce waste in cable cutting

Formed three-wire drop can be put up and sagged before the cable is cut by using this new service wedge clamp, says its manufacturer, and mistakes in judgment that cause cable to be cut too short or too long can be eliminated. The clamp comes in two sizes to cover conductors from 1/0 ACSR to 6 solid.

Attachment to the bare neutral can be done anywhere on the span. As shown, the aluminum shell is slipped around the bare neutral, then the stainless steel wedge is inserted. Tests are reported to show that the grip is secure as action of the wedge tightens under load and is not dependent on screw clamps. The length of the wedge and shell distributes the load over long surfaces, it is explained.

Stainless steel bail with one leg detachable can be used with spools or knobs as well as hooks. Bronze rope bails are also available. For use with ACSR, this clamp is made with aluminum shell and stainless steel wedge. For copper and Copperweld conductors, the shell is bronze on it. Reliable Electric Co.



ONE OF SEVEN WORTHINGTON DEAERATORS installed by Stone and Webster Engineering Corporation, engineers and constructors for Virginia Electric's growing power system.

Now there are seven Worthington deaerators at Virginia Electric and Power Company

Back in 1939, the Virginia Electric and Power Company first started buying steam power equipment from Worthington.

Since that time, VEPCO has installed seven Worthington direct-contact deaerators in new or existing stations, the latest deaerator going to work in 1953.

There's a good reason for all this repeat business — *performance*. Worthington deaerators, like all Worthington steam power equipment, are built for service, built to keep going year after year under the most rigorous operating conditions. Features like easy tube accessibility, Worthington's patented tray system and specially designed distributing weirs add up to economical, dependable operation — with extremely low maintenance costs. Matter of fact, we think our deaerators are the best salesmen we have.

Get in touch with your nearest Worthington district office for bulletins and information. Or write to Worthington Corporation, Steam Power Division, Section S.4.1, Harrison, New Jersey. S.4.1

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CONSTRUCTION NEWS

Savannah, Ga. — Savannah Electric & Power Co., Savannah, has authorized an appropriation of $4,500,000 for expansion and improvements in Riverside generating station, where new 20,000 kw turbine-generator will be installed, power substations, transmission lines, and other operating facilities.

Chicago, Ill. — Commonwealth Edison Co., 72 West Adams St., plans an expenditure of $425,000,000 during next 48 mos., 1954–1957, for expansion and improvements in plants and system, including increased generating facilities, transmission lines, power substations, distribution lines, etc.

Logansport, Ind. — City Council, City Hall, is considering construction of new municipal light and power plant, with turbine-generator, high-pressure boiler and auxiliary equipment, details of equipment and capacity to be determined soon. Entire project reported to cost approximately $3,400,000.

Great Bend, Kan. — Western Light & Telephone Co., Kansas City, Kan., has plans maturing for expansion and improvements in electric generating plant at Great Bend, with installation of new generating unit and auxiliary equipment, to cost about $3,000,000. Work is scheduled to begin at early date. Sargent & Lundy, 140 S. Dearborn St., Chicago, is consulting engineer.

Calvert, Ky. — General Aniline & Film Corp., 435 Hudson St., New York, N. Y., plans power house at proposed new chemical plant at Calvert, where large tract of land has been acquired. It will be given over to production of high-pressure acetylene derivatives, including alcohol, etc., and will consist of a number of one and multi-story structures. Processing and other equipment will be installed for large output. Cost estimated about $6,000,000. Work is scheduled to begin soon.

New Orleans, La. — Anheuser-Busch, Inc., 721 Pestlozzi St., St. Louis, Mo., beer, ale, yeast, etc., has engaged Svedrup & Parcel, Inc., Syndicate Trust Bldg., St. Louis, consulting engineer, to prepare plans for proposed new brewery in Jefferson Parish, near New Orleans, where tract of 150 acres of land has been acquired. As previously reported in these columns a steam-generating plant will be installed. Entire program will comprise a series of one and multi-story buildings, estimated to cost close to $20,000,000, with equipment.

Shreveport, La. — Southwestern Gas & Electric Co. is arranging for sale of bonds to an amount of about $10,000,000, approximately $2,500,000 of which will be used for expansion and improvements in generating stations, power substations, transmission lines and other operating facilities.

Everett, Mass. — Boston Edison Co., Boston, Mass., is reported planning expansion in steam-electric generating station at Everett, known as Mystic Plant, with installation of equipment for increased capacity.

Marquette, Mich. — Upper Peninsular Generating Co., 16 Sheldon Ave., Houghton, Mich., will proceed at once with proposed new steam-electric generating plant at Marquette, for which general contract for design and supervision of construction has been let to Stone & Webster Engineering Corp., 33 S. Clark St., Chicago, Ill. It will be equipped for initial capacity of 22,000-kw. Cost estimated about $7,500,000, including transmission line to Ishpeming, Mich., for service at plant of Cleveland Cliffs Iron Co. at that place, as previously noted.

Joplin, Mo. — Empire District Electric Co., 602 Joplin St., has arranged financing in amount of about $4,000,000 through sale of a block of deferred stock. Proceeds to be used for extensions and improvements in power plants, power substations, transmission lines and other operating facilities.

St. Louis, Mo. — Mississippi River Fuel Co., 407 Eighth St., natural gas and by-products, plans steam power house at proposed new plant for production of anhydrous ammonia on tract of about 500 acres of land in Jefferson County, Mo., fronting on Mississippi River. It will comprise a series of one and multi-story processing and production structures, with capacity of about 200 tons of ammonia per day. Entire program reported to cost about $15,000,000.

Greensboro, N. C. — P. Lorillard Co., 119 West 40th St., New York, N. Y., cigarettes, tobacco pipe mixtures, etc., plans power house at new cigarette factory at Greensboro, comprising a large one and multi-story building and several smaller structures. Project to represent an investment of about $13,000,000.

Lincolnton, N. C. — Bell Co., 67 Millbrook St., Worcester, Mass., woolens and worsted goods, plans boiler house at new branch textile mill at Lincolnton. Program will consist of a main one-story building and several smaller structures, entire project to cost approximately $1,000,000.

Cleveland, Ohio — Cleveland Electric Illuminating Co., Public Square, plans improvements in Eastlake steam-electric generating station, program to include installation of new coal-handling equipment and accessories, including pulverizer, heater, dryer, etc.; also water pollution control apparatus and miscellaneous work. Project reported to cost about $2,000,000. C. A. Dauber, director, mechanical engineering department, in charge.

North Wales, Pa. — Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa., electrical measuring and recording instruments, control instruments, etc., is reported planning boiler house at proposed new plant at North Wales, comprising a number of buildings, with main structure approximating 250,000 sq ft floor space. Entire project estimated to cost about $4,000,000. Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich., is architect and engineer.

Philadelphia, Pa. — United States Engineer Office, 121 North Broad St., has plans under way for extensions and improvements in steam-electric generating plant at local Frankford Arsenal, including electrical distribution system. Cost reported close to $3,000,000. Albert C. Wood Associates, Inc., 1411 Walnut St., Philadelphia, is consulting engineer.

Shiremanstown, Pa. — Ralston Purina Co., 835 S. Eighth St., St. Louis, Mo., cereals, animal feeds, grain products, etc., plans steam power house at proposed new branch mill on St. Johns Rd., Shiremanstown, where tract of land has been acquired. It will consist of a main one-story building, with processing and other equipment for production of dog foods. Cost about $1,000,000. Construction Management, Inc., 1542 W. Washington St., Indianapolis, Ind., is engineer.

Johnsonville, S. C. — Nichols & Co., Inc., 140 Federal St., Boston, Mass., wool tops and other wool products, plans steam power plant at proposed new mill at Johnsonville. It will consist of a main one-story building for processing and general production, with several auxiliary structures. Entire program reported to cost close to $3,000,000.

Chattanooga, Tenn. — Central Soya Co., and McMillan Feed Mills, Fort Wayne Bldg., Fort Wayne, Ind., affiliated, plan boiler plant at new mill near Chattanooga, for production of soybean products and mixed animal feeds. It will consist of several processing and manufacturing buildings, equipped for large output. No estimate of cost announced — will represent sizable investment. Work is scheduled to begin soon.

El Paso, Tex. — Tempron Corp., care of Tayler Corp., 46 Trinity Pl., New York, N. Y., engineer, plans power house at proposed new paperboard mill on 1400-acre tract of land near El Paso. It will comprise a series of one and multi-story buildings for general production. Proposed to begin work soon. Cost reported approximately $4,000,000. Engineer noted is in charge.

Houston, Tex. — Texas Gulf Producing Co., Mellie Esperson Bldg., petroleum products, natural gas, etc., plans steam power house at proposed new natural gasoline plant in Headlee gas field area, Ector County, Tex., where large tract of land has been secured. Plant will be equipped to process about 15 million cu ft of natural gas per day, and is reported to cost approximately $2,000,000, with compressor station and other mechanical units. C. F. Braun & Co., 1000 S. Fremont Ave., Alhambra, Calif., is engineer.

Port Arthur, Tex. — Koppers Co., Koppers Bldg., Pittsburgh, Pa., coke, chemicals, etc., plans steam power house at proposed new polyethylene plastics plant at Port Arthur, where tract of land has been secured. It will comprise a number of one and multi-story buildings, with processing and other equipment for large output. Cost reported in excess of $20,000,000.

Salt Lake City, Utah — Utah Power & Light Co. has arranged financing through sale of bond issue, totaling $15,000,000, proceeds to be used for expansion and improvement in plants and system, including increased generating facilities, power substations, transmission lines and miscellaneous work.

Wauwatosa, Wis. — Briggs & Stratton Corp., 2711 N. 13th St., Milwaukee, Wis., gasoline engines and parts, automobile equipment, is reported planning boiler house at proposed new plant at Wauwatosa, near Milwaukee, comprising a number of one-story buildings, to be equipped for large increased output. Entire project will cost about $5,000,000. Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich., is architect and engineer.

here's how high temperature piping can flex its muscles

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NAVCO *Counterpoise* Pipe Hangers

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CON EDISON SELECTS...

The control gage board for Astoria's No. 10 boiler. At top: Hays Model WSF for mounting above eye level. Right center: Hays Model WCF8P for eye level. Four mounting styles are available to meet special requirements.

NEWEST TYPE **Hays Draft Gage**

Consolidated Edison's new Astoria Electric Generating plant at Queens, N.Y. is equipped specifically for the purpose of producing electricity at the lowest cost per kilowatt, reliably and continuously.

To meet these exacting requirements, Con Edison selected Hays W Gage . . . a completely new design in draft gages. Like other Hays low pressure instruments, the draft gage operating mechanism consists of a diaphragm enclosed in a cast metal housing. For pneumatically transmitted readings of Air, Steam, or Water Flow, Pressures, Temperatures, Levels, Oxygen, etc., the operating mechanism employs a bellows. The outstanding new features include: 3-way atmospheric vent cock, easy zero check, removable units for simple adjustment, and Lucite scales for easy reading.

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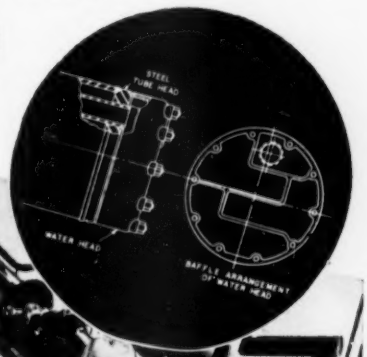
$ave Power and REFRIGERATION COST

Vogt Condensers, because of their correct design, STEP UP the rate of heat transfer and STEP DOWN head pressures. With the liquid delivered at a lower temperature, smaller compressor capacity is needed, saving in original as well as operating costs.

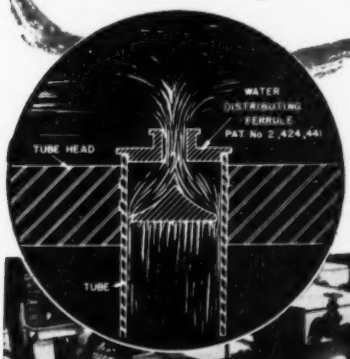
One of the two basic types illustrated will fit your operations exactly. Install Horizontal Multipass (closed type) for use with clean waters. Where the water is hard, forms scale, contains mud or promotes fungus growth, Vertical Single Pass (film type) which can be cleaned in operation, are recommended.

Horizontal Multipass Condensers
(Closed Type)

Water circulated in tubes traverses the length of the unit a number of times as determined by baffles in the heads.

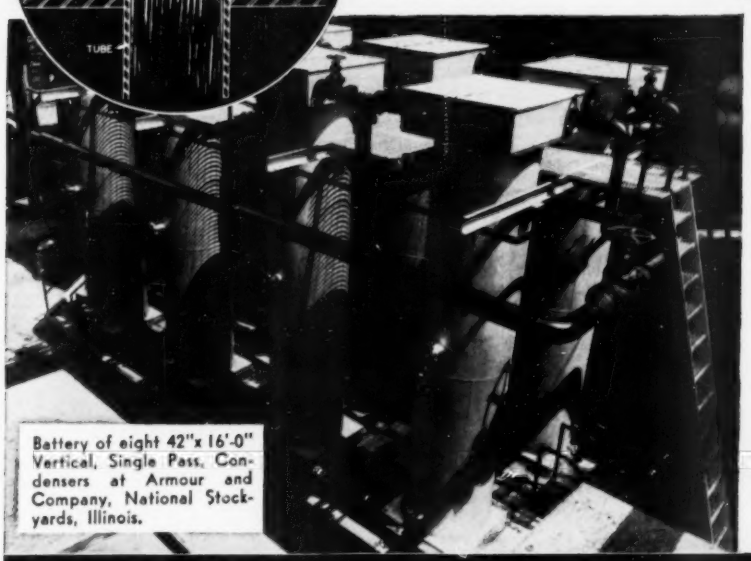


375 tons capacity Multipass Condenser installation at Railways Ice Co., Belen, New Mexico.



Vertical Single Pass Condensers
(Film Type)

Patented ferrules give equal distribution of water to and over the surfaces of all tubes in a unit.



Battery of eight 42"x 16'-0" Vertical, Single Pass, Condensers at Armour and Company, National Stockyards, Illinois.

HORIZONTAL and VERTICAL TYPES SHELL and TUBE CONDENSERS For Every Service

Write For Bulletin RC-1

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Vogt REFRIGERATION CONDENSERS

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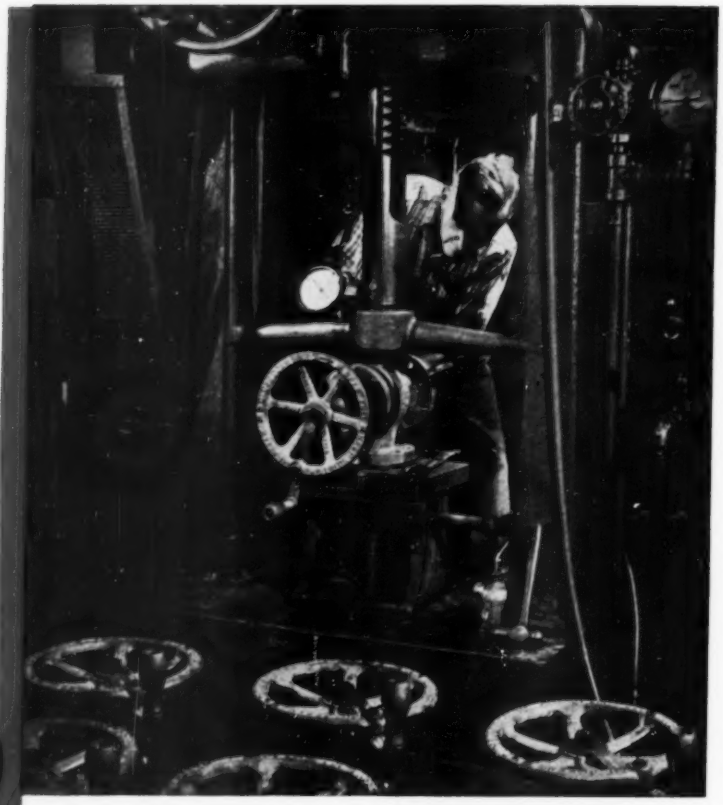

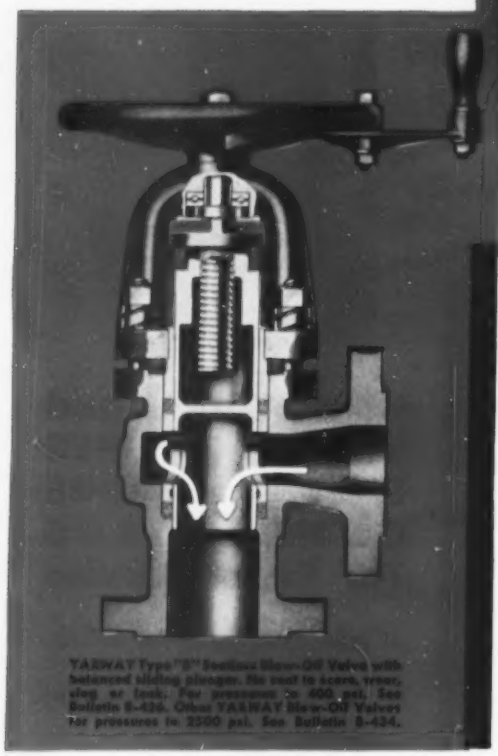

YARWAY Type "S" Seatless Blow-Off Valve with balanced sliding plunger. No seat to score, wear, clog or leak. For pressures to 400 psi. See Bulletin B-434. Other YARWAY Blow-Off Valves for pressures to 2500 psi. See Bulletin B-434.

THIS PRODUCTION "DOUBLE CHECK" SAFEGUARDS YOUR BOILER INVESTMENT!

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In this corner of the YARWAY Testing Department, *every Yarway Blow-Off Valve* is hydrostatically tested at 1½ times its rated maximum working pressure—proved drop-tight for service far beyond normal expectancy.

Not only blow-off valves, but *all* YARWAY equipment undergoes rigorous tests before leaving the YARWAY plant. Why? For one reason—to assure longer and better service in *your* plant. Over 15,000 boiler plants are using YARWAY Blow-Off Valves—some for twenty-thirty years, or longer.

Whenever you are in need of boiler blow-off valves, be sure to *make Yarway your way*.

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YARWAY **steam plant equipment**

BLOW-OFF VALVES
WATER COLUMNS AND GAGES
REMOTE LIQUID LEVEL INDICATORS
EXPANSION JOINTS
DIGESTER VALVES
STEAM TRAPS
STRAINERS
SPRAY NOZZLES

For more data circle 541 on Post Card

Modernized Conveyer System Increases Coal Handling Capacity

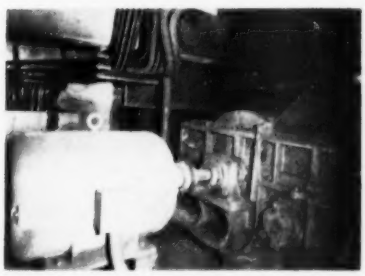
Vineland, N. J., expanded its municipal power plant to add 10,000 kw to its output. The expansion outmoded the old skiphoist and necessitated a new coal handling system. A fully automatic conveyor was installed that handles coal not only for the expanded plant, but will also service equipment that will be added soon to furnish another 12,500 kw capacity. The new system is designed to: (a) convey coal directly from hopper-bottom cars to old or new storage bunkers, (b) carry coal to an outdoor storage yard, or (c) deliver coal from the yard into the bunkers. The system can handle up to 100 tons of coal per hour

By HOWARD M. DOWN
General Manager, Municipal Utilities, Vineland, N. J.

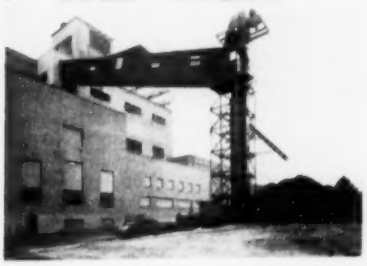
1 Coal cars are pulled into a shed where they discharge into double track hoppers located under the car

2 The hoppers feed the dumped coal to the underground reciprocating feeders that supply the conveyor lift

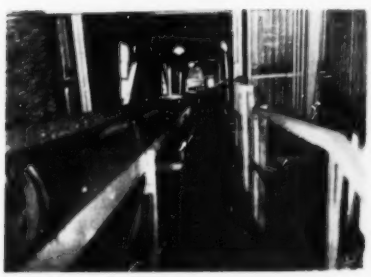
3 The four-ply rubber-covered belt conveyor carries the coal upward into the ring-type 50-hp crusher mill



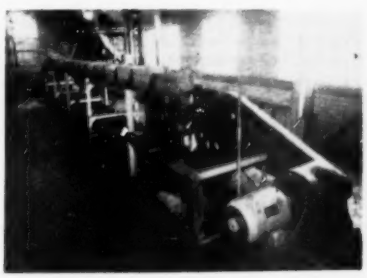
4 The crusher empties into a bucket elevator. Part of the elevator, the crusher, and its motor show here



5 This elevator carries coal above ground and delivers it either to the yard storage or overhead conveyor



6 The overhead belt conveyor hauls coal to the powerhouse, feeding it into one of the two flight conveyors



7 The flight conveyors supply coal by scraping it from the conveyor discharge over the top of the bunkers

8 A master panel in the unloading shed controls the entire system, and ensures proper operating sequence

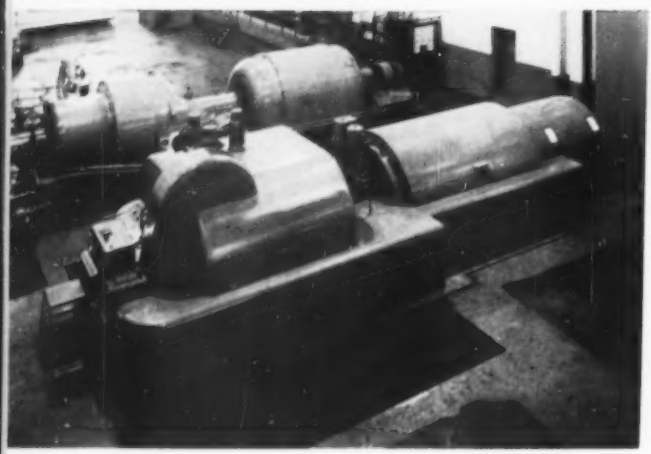


Fig. 1 New 12,500-kw (nominal) turbine exhausts at 200 psig

Goodyear Modernizes Akron Power Plant

This "necessary evil" type investment turns out to be good business when Goodyear's new power plant addition generates 440,000 lb of process steam per hour and 15,600 kw for the same fuel needed by the older equipment to produce the process steam without electric power generation

By W. E. PICKARD *

EARLY IN 1950 the management of the Goodyear Tire & Rubber Company was faced with a number of major problems in providing adequate steam and electrical energy for its largest manufacturing plant located at Akron, Ohio. The nature of their problems demanded careful, long-range planning. Principal problems facing the organization were:

a. Obsolete equipment: Steam generating units representing 1,000,000 lb per hour of the plant capacity were installed between 1910 and 1919.

b. High steam and electrical demand: Growth in production facilities and full operating schedules had steadily increased the demand for these utilities.

c. Civic program on elimination of air pollution: The older steam generators were not equipped with fly ash collectors.

The company's engineering staff entered upon a complete study of the problems and called upon Sargent & Lundy Consulting Engineers for their help with the study. It was completed and estimates were submitted on the cost of equipping existing boilers with fly ash collecting equipment. It was ascertained that it would have been a poor investment to install such equipment on units then 40 years old. The investigation was then extended to ascertain if the investment might not be more profitable if applied to the replacement of this old equipment.

Space Problem

Replacing the old generating capacity was complicated by the physical layout of the power house and installed equipment. Manufacturing buildings on all sides limited the space available to that which was covered by the existing boiler and turbine room roofs. The turbine room could house another turbine without any major equipment moves, but space for the boilers, auxiliaries, water treatment equipment, etc., would have to be gained by the removal of boilers.

In other ways, too, the existing plant put limitations on the engineers. The handling of fuel and ash had to be adapted to the existing system and of course, the new equipment would have to be designed to fit the existing cycle. There was demand for steam at 100, 200 and 300 psi, demand for electrical energy, and an extremely variable feed water treatment and heating problem to be met. Other factors to be considered in the study included future demands on the system and ways and means to maintain operations while the installation was being accomplished.

Alternates Considered

Installation of one, two, and three steam generating units of various capacities and pressures and a topping turbine of a capacity about equal to that of the boilers in each respective case was studied to compare the investment versus the return for each combination of equipment.

Capacities and operating pressure of the new boilers for each case were the principal design factors for the water treatment plant. The treatment plant capacity established the amount of heat required in the treatment cycle. Operating pressure dictated the degree of water purification that was necessary.

The most economical fuel in the Akron area is coal that is strip-mined in adjacent counties. It has a relatively low calorific value and arrives at the plant with a high moisture content. To make matters worse, the quality of this coal varies widely with each shipment. It was decided to design the combustion control system to absorb the variations in coal quality and make the burning equipment have sufficient capacity to deliver full boiler capacity on coal with a calorific value as low as 10,500 Btu per pound. Consideration was given to pulverized fuel systems and cyclone type burners. The cyclone type burner adapts well to handling the lower grades of coal, but the variable demand for steam made a pulverizer system the better choice of the two.

It was concluded that two 220,000 pound per hour boilers that would operate at 875 psi arranged for pulverized coal firing and connected to a 15,600 kva topping turbine should be installed. This equipment would provide an adequate solution to the immediate problem and offered the best return on the capital investment. The return on the capital investment manifests itself in savings of fuel and can be demonstrated by the fact that the new equipment now generates 440,000 pounds of 200 psi steam and some 15,600 kw of electrical energy with less fuel than the old units burned to produce the steam alone.

Boilers, supplied by Babcock & Wilcox, are of a two drum, single pass, baffleless design. They are equipped with water walls, superheaters, coal pulverizers and single speed induced and forced draft fans. Their design pressure is 975 psig and they are rated at 220,000 pounds of steam per hour each, with a final steam temperature of 835 F. The single pass, baffleless design was selected because of its simplicity and its saving in draft losses and maintenance. The fire sides of the tubes are kept cleaner because there are fewer pockets in which the ash can collect and deposit and there is a much lower incidence of tube cutting by the ash because of the straight through flow of the gases.

200 PSI Exhaust

The turbine generator was supplied by Allis-Chalmers. The turbine is of the impulse-reaction type and is designed for initial steam conditions of 850 psig and 825 F. It exhausts against 200 psig back pressure and

*Steam Engineering Division, Goodyear Tire and Rubber Company

will develop 15,625 kw (maximum) at 3600 rpm.

The generator has a maximum rating of 15,636 kva with a nominal rating of 12,500 kw at 80 per cent power factor. It has a direct-connected exciter and a closed air cooling system. Heat is removed from the system by a Schutte & Koerting air cooler. The unit is operated at unity power factor as capacitive or reactive kva is supplied by the older generators driven by 200-psi condensing turbines.

Boiler auxiliaries are motor driven except for one of the boiler feed pumps. The motors are of the single speed induction type. The one feed pump turbine operates on 850 psig steam, exhausts against 25 psig back pressure, and supplies exhaust steam to the water treatment system. The auxiliaries include two coal pulverizers per boiler, primary air fans, forced draft fans, induced draft fans and the feed pumps. All the fans are single speed units with damper controls. Combustion control is handled by a completely automatic, steam pressure, steam flow-air flow system. A fuel oil system has been installed for "lighting off" and for load carrying purposes in case of failure to the normal firing system.

New Feedwater System

The feed water treatment plant has sufficient capacity to supply all of the steam generating units. It consists of a 45,000-gallon-per-hour hot process, lime-soda softener followed by four filters and four hot zeolite ion exchangers. Condensate and treated water are heated to 260 F in the 600,000-pound-per-hour deaerating feedwater heater, and then are pumped to the boilers.

The old boiler plant was serviced by coal conveyors which extended the full length of the boiler room passing in front of each of two lines of boilers, which faced a common aisle. To accommodate the new large-capacity units, it was necessary to remove this conveyor in the new portion of the plant. The physical layout that was decided upon placed the new boilers at the end of the plant farthest from the coal hoppers and crushers. Existing conveyors were altered to serve the old boilers and to deliver coal to a new belt conveyor system serving the new boilers. Installation of the two new high-capacity boilers required the removal of six old 50,000-pound-per-hour units. Further expansion will call for further shortening of the old coal conveyor, increasing the length of the belt conveyor system, and the removal of two old boilers for each new unit that is installed.

Operating experience to date indicates that the new equipment meets the specifications and that the overall performance of the new equipment is excellent. Sound engineering has turned an investment of the "necessary evil" type into a profitable investment venture.

This plant is an excellent illustration of the way economic replacement times can creep up on a company through the passage of time and the advances in "the state of the art." In this case, outside pressure in the form of civic air pollution programs served as a "trigger" to initiate action which was thoroughly justified on principles of cost and adequacy of power facilities.

Power demands in the foreseeable future can be met with the new plant, local smoke ordinances are met, and a substantial reduction in costs resulted from this modernization.

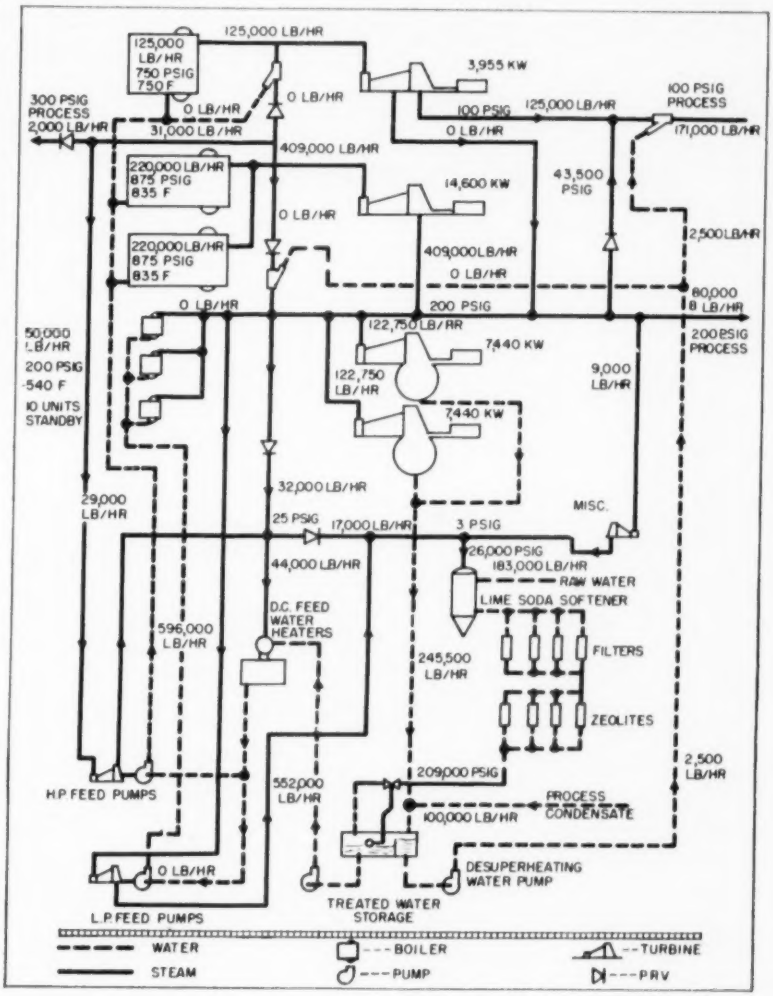


Fig. 2. Steam flow diagram for typical conditions (older boilers are on standby)

Tabulation of principal new equipment installed in the modernized Goodyear plant

2 Boilers—Babcock & Wilcox: 220,000 lb per hr; 975 psig; 835 F; 2-drum, single-pass, baffleless with superheater, water walls, and air heater.
Turbine-Generator—Allis-Chalmers: 12,500 kw at 0.8 pf; 3600 rpm; 850 psig 825 F inlet; 200 psig exhaust.
4 Coal Pulverizers—Babcock & Wilcox: Type E, size 56; GE motor drive.
4 Primary Air Fans—American Blower Co.: Direct-connected to GE motor drive.
2 Forced Draft and 2 Induced Draft Fans—Green Fuel Economizer Co.: Direct-connected to GE motor drive, single speed.
2 Fly Ash Collectors—Western Precipitation Co.: "Multiclone" type 9-VG-12.
2 Feed Pumps—Worthington: 8UX1; 1165 gpm, 2575-ft head; one motor driven, one turbine driven.
Hot Lime-Soda Softener—Worthington: 45,000 gal per hr; 6500 gal storage.
4 Vertical Pressure Filters—Worthington: Each 8 ft 6 in. in diameter.
4 Hot Zeolite Softeners—Worthington.
Deaerating Heater—Worthington: 600,000 lb/hr.
2 Coal Conveyors—Stephens-Adamson.
Pneumatic Ash Handling System—United Conveyor.
Pressure Reducing and Desuperheating Station—Swartout.
Boiler Controls—Hagan Corp.
Meters—Bailey Meter Co.
Turbine Air Cooler—Schutte & Koerting Co.
Turbine Oil Centrifuge—DeLaval Separator Co.
Phosphate Pumps—Proportioneers, Inc.
Sulphite Pumps—Proportioneers, Inc.
Ventilation Fan—Clarage Fan Co.

In May we described heater drain pump systems and explained some of the points to watch when choosing new pumps or checking old ones. Here is some more information on the same subject

More on Feedwater Heater Drain Pump Systems

By T. W. EDWARDS*

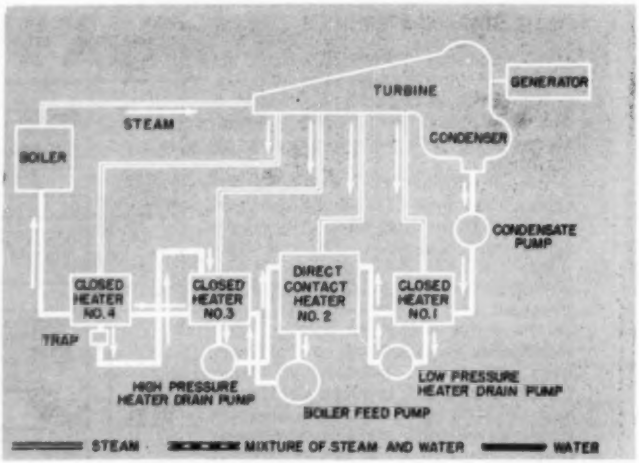


Fig. 1. This diagram shows the conditions under which a heater drain pump is able to operate under negative head

IN THE FIRST PART of this article, published in May 1954, we explained the differences between open and closed systems for heater drain pumps, showed why the characteristics of the pumps had to be different for each system, and explained some of the factors which have to be considered when selecting these pumps. The discussion of those factors is continued in this second part of the article.

Since closed feedwater heaters are usually located at a low elevation with respect to the rest of a given power station, Net Positive Suction Heads available are necessarily limited. This imposes a further restriction on the type of pump suitable for heater drain service — that it must be capable of satisfactory operation under extremely low NPSH conditions. Further, the adverse effects of rapid station load changes are even more apparent in heater drain pumps than in boiler feed pumps and condensate pumps. This requires that the maximum margin possible be allowed between the NPSH requirements of the heater drain pump and the NPSH made availabie to the pump by the system.

It is, therefore, frequently necessary to select a heater drain pump with as steep a head-capacity characteristic as possible to completely envelop the system head characteristic, but not necessarily parallel it. Usually light load operating conditions will determine the pump to be used since this will be the highest head condition. Then, excess head developed by the pump at other load conditions must be throttled off. This throttling off represents a very real and costly station loss in auxiliary horsepower consumed which can be of far more significance in actual evaluation than a few points of pump efficiency. Where, under normal load conditions, it is necessary to throttle off perhaps several hundred feet of excess pressure, pump efficiency becomes a relatively minor factor.

While, in the application of centrifugal heater drain pumps serving intermediate heaters, a positive system pressure always exists, it is interesting to note that under certain conditions a heater drain pump can operate against a negative head when serving the high pressure heater located just after the main boiler-feed pump. This application involves an open system and the heater drain pump discharges to the lower pressure deaerator ahead of the boiler feed pump rather than pumping to the higher pressure boiler-feed water line after the heater. (See Fig. 1.) Not only does this particular heater drain pump handle the drains from this one heater, but it can also handle the drains from subsequent heaters cascaded to it. Since this heater drain pump discharges into the deaerator, it can be seen that the pressure against which it must pump at all station loads is the sum of the following:

1. Static difference in elevation between the water level in the heater hot-well and the water level in the deaerating heater. This static water level is usually rather high since the deaerator is located at the highest elevation possible to produce ample Net Positive Suction Head at the main boiler feed pump; and is very nearly constant at all loads.

2. Friction loss in the piping, which of course, decreases with decreasing load.

3. Less the differential in operating pressure between the heater and the deaerator. This differential varies with the load and approaches zero at no load.

Fig. 2. shows these various factors individually and a summation of them. The system pressure thus produced is actually negative at normal load conditions, where the pressure differential factor between the heater and deaerator is sufficient to overcome friction losses and the static water level difference. At light loads, however, this pressure differential reduces to the point where it is inadequate to overcome the other two factors and a positive pressure condition results. Naturally a pump is required for part load operation even though at full load flow would take place without it. As a matter of fact, this pump is normally operated at all times as a safety measure and also to allow swings in the load without attention to the pump. Excess head is throttled off at normal load conditions.

There is one additional heater drain pump which has not been previously mentioned. Occasionally, the drains from high pressure heaters located after the main boiler feed pump are reintroduced into the boiler feedwater cycle directly through the use of high pressure heater drain pumps. See Fig. 3. It should be noted that this arrangement is falling from general favor in view of increased boiler feed pump discharge pressures. Naturally the initial cost of the pump would be exceedingly high and would far outweigh any heat balance advantage derived from its use. The application, however, does warrant mention since it is still to be found in

*Application Engineer, Worthington Corporation

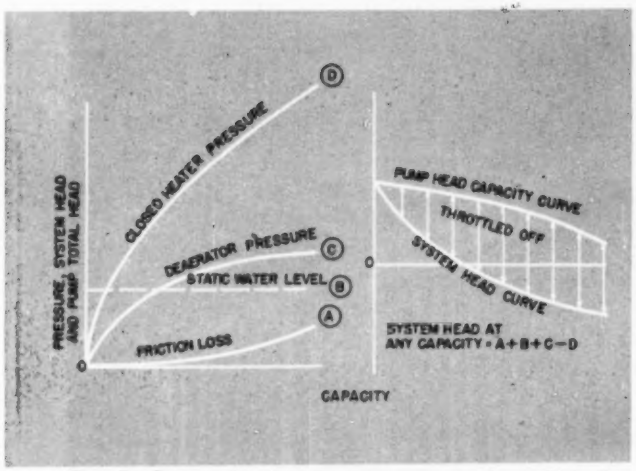


Fig. 2. Curves showing the pressures against which the heater drain pump (shown in Fig. 1) must pump at all loads

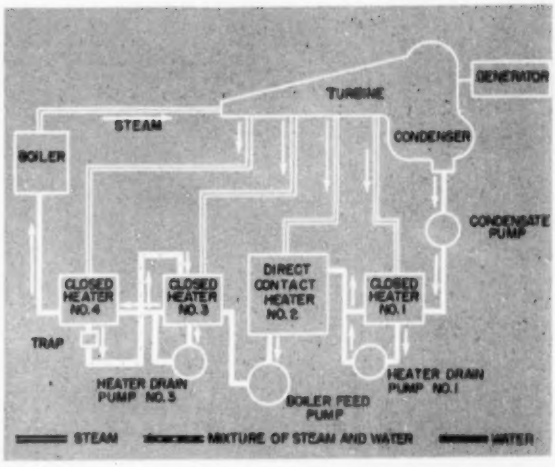


Fig. 3. Showing how drains from hp heaters located beyond the bf pumps are returned to feedwater cycle by the pump

low pressure installations. It is similar in general arrangement to the case of intermediate heater drain pumps in a closed cycle. Hydraulically also, pump operation is similar; and the general shape of the system head characteristic is the same. Again the pressure in the system, and hence the pressure to be overcome by the heater drain pump increases with decreasing load, due to the increase in constant speed boiler feed pump discharge pressure with decreasing load. Pumps hydraulically similar to those used to drain intermediate heaters in a closed system are required.

Heater drain pumps applied to these latter services, however, must be in effect miniature boiler feed pumps since suction pressures encountered are necessarily quite high, and the drains themselves are at correspondingly high temperatures. This, of course, involves many special construction details which will not be discussed here. But, hydraulically speaking, these various special operating conditions necessitate that great care be exercised in the application of all heater drain pumps.

Operating pressures and temperatures must be known at all load conditions. If only normal load conditions are made known to the manufacturer, it is very possible that a heater drain pump will be installed which will operate satisfactorily at normal load but fail completely to drain the heater at light loads. Such a unit would be completely unsatisfactory, and would destroy station economy and heat balance. Since a new power generating unit is most efficient when it is first installed in a given station, for a period of time it will be allowed to operate always at full load. Swings in the load would then be taken by older and less efficient units. Hence, the inadequacy of an improperly applied heater drain pump might not be immediately apparent. However, as time goes on, and more efficient units are added, this unit may be required to take load swings. Under these conditions, this inadequacy might become painfully apparent, and require costly pump replacement. Hence, proper installation of all heater drain pumps with an eye to possible future operating conditions will always pay off.

Oak Ridge Modernizes Steam Supply

EXCAVATION FOR a new steam plant at the Y 12 operations of the Atomic Energy Commission's Oak Ridge facilities is completed and the work of developing foundations is now under way. Because of war-time shortages, used boilers were originally installed in the present steam plants. These boilers have become increasingly uneconomical to operate and maintain in recent years. One of the group has been condemned and the condition of the others, as indicated by inspection reports, has made it necessary to reduce the allowable pressure to meet safe operating standards. Because of these and other factors, building a completely new steam plant has become necessary.

The new steam plant was designed by the Carbide & Carbon Chemical Co.'s engineering department and turned over to Burns & McDonnell Engineering Co. The construction contract is with the Rust Engineering Co., who are also engaged in performing other large-scale remodeling work in the area.

There will be three Wickes boilers in the new Y 12 plant, capable of producing a total of 750,000 pounds of steam per hour at 250 pounds pressure and a temperature of 600 F.

Special water treatment process includes zeolite treatment and deaeration followed by caustic, phosphate and sulfite post treatment.

The new plant is designed to burn pulverized coal, but it can be adapted to utilize fuel oil or natural gas if a change becomes desirable in the future. The old steam plants, which are being replaced, are gas fired. The coal will be delivered by the Louisville & Nashville Railroad to the plant's outer security fence from which point the dieselized equipment of the plant will couple on. The contents of the cars dump through screened covers of under-track hoppers. A belt conveyor, equipped with a special weighing scale, will carry the coal from the hopper to a pulverizer and from thence it will be blown into the furnace.

Ash removal will be handled by a hydraulic sluicing system which will carry the ash through a pipeline to a dumping point outside the controlled (security) area. Concrete block manufacturers see that the dump never becomes congested.

At present, the entire steam-distribution system is operating on a non-return basis. However, an extensive survey was conducted recently by student members of M I T, and their figures may result in an appropriation to add the needed condensate return lines and booster pumps.

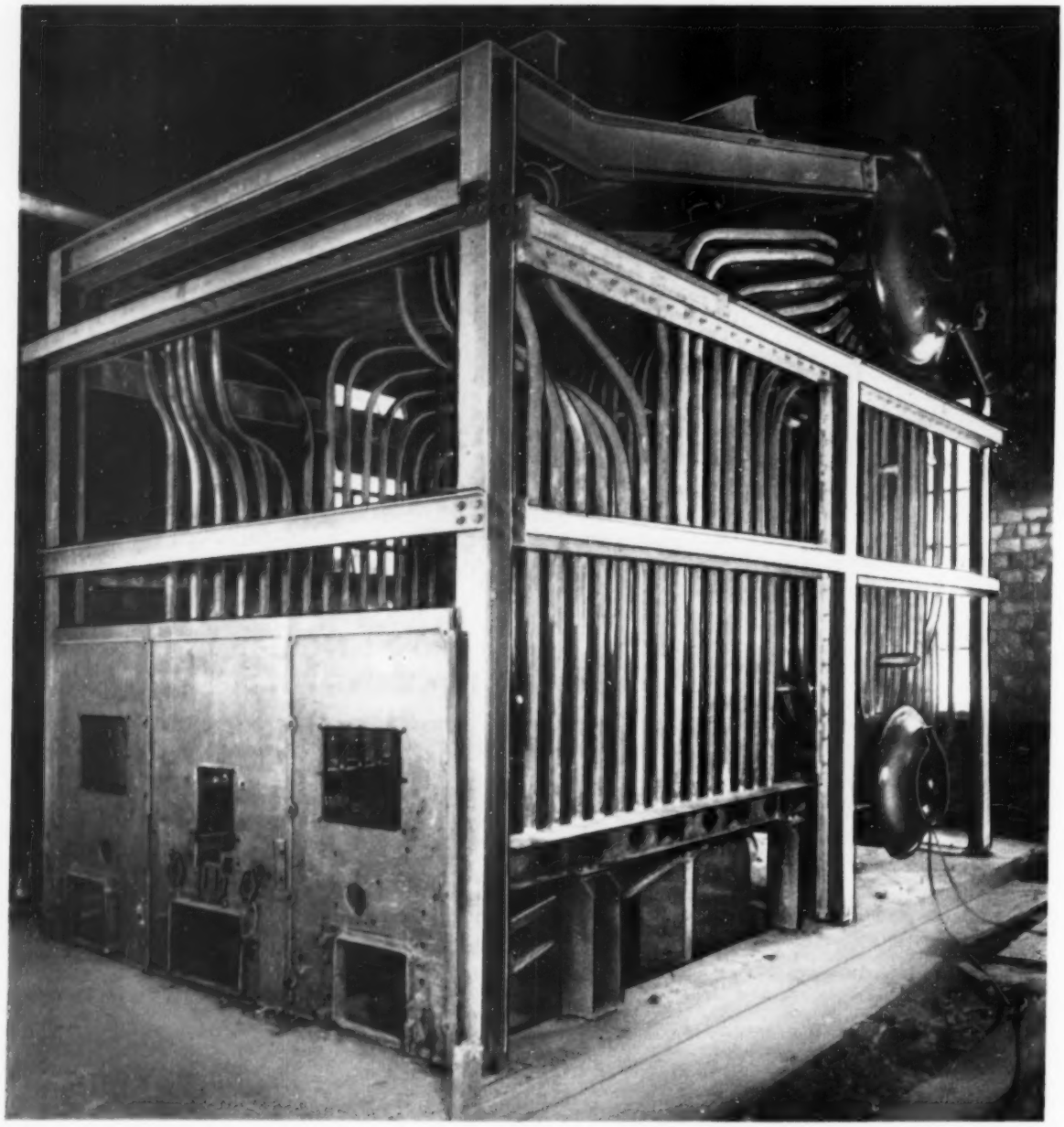


Fig. 1. View showing front and side of one of new Vogt two-drum type water tube and water wall boilers during construction

One Boiler for Four at Stitzel-Weller

During the modernization of an old four-boiler steam plant at Stitzel-Weller's distillery in Louisville, Kentucky, it was necessary to maintain steam generation in order not to interrupt production. One of the old boilers was dismantled, and the first of the new steam generators installed; this boiler carried the entire load for 60 days, reaching peaks of 375 per cent of capacity

By ANDREW CORCORAN*

MODERN NEW POWER equipment got off to a fast start in proving its worth at the Stitzel-Weller Distillery in Louisville. The first unit alone of a new three-boiler installation met all power requirements for two months while the other steam generators were being installed, and reached peaks of 375 per cent of rated capacity, or slightly more than 33,000 pounds of steam per hour. During these two months, this one unit did the job formerly done by four boilers over the previous 15 years.

The four original HRT Vogt 150-horsepower boilers were installed in 1935 to produce steam to operate the distillery at 500 bushels of grain a day. At that time, production was just being resumed full-scale after repeal of the prohibition law and the original 100-foot brick stack was installed to a five-foot diameter at the top. A growing market led the company to increase its daily distilling load to 2,000 bushels a day in 1947. To accommodate the increased load, a new brick stack was built to 150 feet, with a six-foot diameter at the top.

With the new stack the power plant was able to reach a maximum rating of 160 per cent, or 240 horsepower per boiler. But combined efficiency for the power plant was reduced to 54 per cent. Plans for a new boiler plant were approved in June, 1951, and the equipment was ordered from the Henry Vogt Machining Company in Louisville. It was agreed with the contractor that the distillery was to remain in production as much as possible during the installation of the new equipment.

As the first step, it was decided to take out one of the old units, and install one of the new boilers; the distillery was to remain in production with the three remaining old units during this time. As it turned out, the plant was able to operate without difficulty at three-fourths capacity on the three old units for approximately 60 days.

When the one new unit was completed and put on the line, the distillery was able to resume full capacity. The remaining three old units were then removed, and a start made on installing the two new power units. Our engineering staff had anticipated that the distillery could operate this one new unit at 250 per cent of rating, which would produce 21,600 pounds of steam per hour. Actually the single new unit reached up to 375 per cent of rated capacity, as already noted.

In order to boost the plant up to this level, it was necessary to burn washed Western Kentucky No. 11 Seam Coal $1\frac{1}{2}$ by $1\frac{3}{4}$ inches in size. No attempt was made to attain efficiency while this operation was being conducted.

As soon as the second new steam generating unit was installed, we began using $1\frac{1}{4}$ inch by 28-mesh washed Western Kentucky No. 11 Seam Coal, which would analyze as loaded as follows:

Moisture, 8 per cent
Volatile matter 38.6 per cent
Fixed carbon 47.4 per cent
Ash 6 per cent

The sulphur content would be 3.13, and the Btu value approximately 12,500.

Using this coal and operating the furnaces at 250 per cent of rating, the average efficiency of the Stitzel-Weller operation runs approximately 74 per cent.

The new power units are water-tube two-drum water-wall steam generators with a normal rating of 262 horsepower. The new Vogt boilers are equipped with Westinghouse underfeed stokers, single retort. The air supply is furnished by Westinghouse forced-air fans. The Westinghouse system of overfire air is used to create turbulence and eliminate smoke.

Tube slagging is controlled by use of two and one-half pounds of Gamlenite per furnace per day. Vulcan soot blowers are employed twice a day to remove all soot.

The satisfying initial performance of the one new unit proved indicative of the long-range worth of the installation. Never at any time since the boilers have been in operation has the distillery lacked adequate steam. This is particularly important in our operation because it is necessary that the distillery operate every day of the year in order to maintain the continuity of its processes. Although the company's distilling method calls for a lower mashing temperature, it is carried on a longer period of time and therefore requires more steam in a steady supply.

Important economies in maintenance have resulted from the new power installation. With the old boilers it was necessary to take the old unit "off the line" once a month for scale removal and washing out. This cost was estimated at about $10,000 a year including re-bricking. New grates were installed on an average of once a month for each boiler. This cost some $4,000 annually. Service costs and repair parts ran the annual maintenance total on the old boiler plant to at least $16,000.

Since installation of the new power plant, there has not been a single repair or service call on the boilers. The new units are being operated six months at a time before being taken "off the line" and there has been no maintenance cost for grates or furnace iron in over a year and a half of continuous operation. A spare parts supply purchased from Westinghouse has remained untouched. In addition, a new reduction of 20 per cent has been obtained in coal consumption.

Auxiliary equipment in the power plant likewise has performed most satisfactorily. Hager Brothers Stoker Feeders with automatic controls keep the hoppers full of coal at all times. Reliance Eye-High gage glasses are used and the Hays system of automatic combustion control is used. In addition, the Cochrane Hot Process Lime and Soda Ash system of water softening has been adopted in conjunction with the Hall Laboratories method of water conditioning.

* Master Distiller, Stitzel-Weller Co., Louisville, Ky.

Fig. 2. Grate dumping engine on one of the new boilers

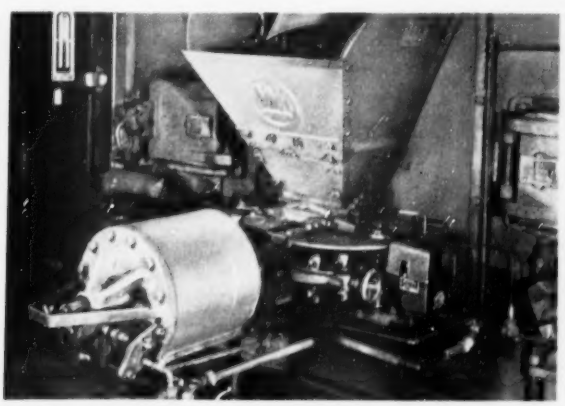


Fig. 3. Details of the stoker, stoker feeder, and gage glass

Last month the authors told how properties of concrete and masonry affect bit design. Here they clear up some misconceptions about the effect of speed and pressure on drilling rates

Masonry Drilling: Best Speed? Best Pressure?

By BERNARD L. CHAPIN* and RALPH H. ALPER†

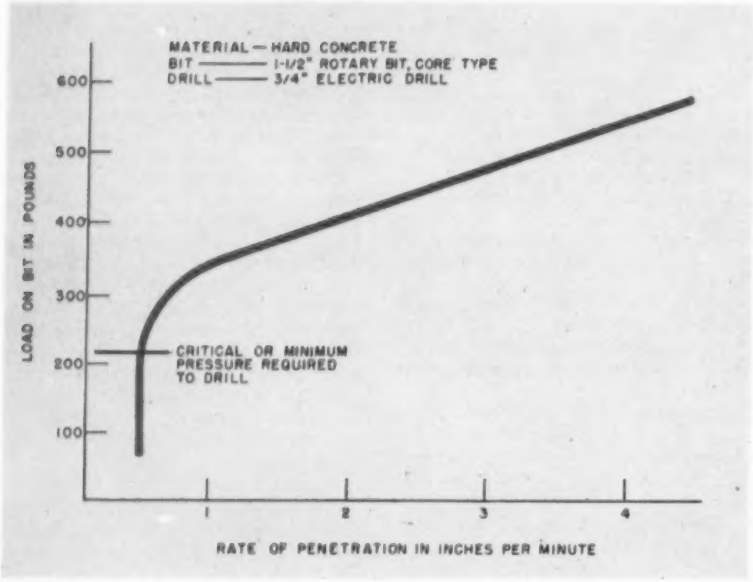


Fig. 1. Curve showing effect of pressure on rate of penetration in hard concrete

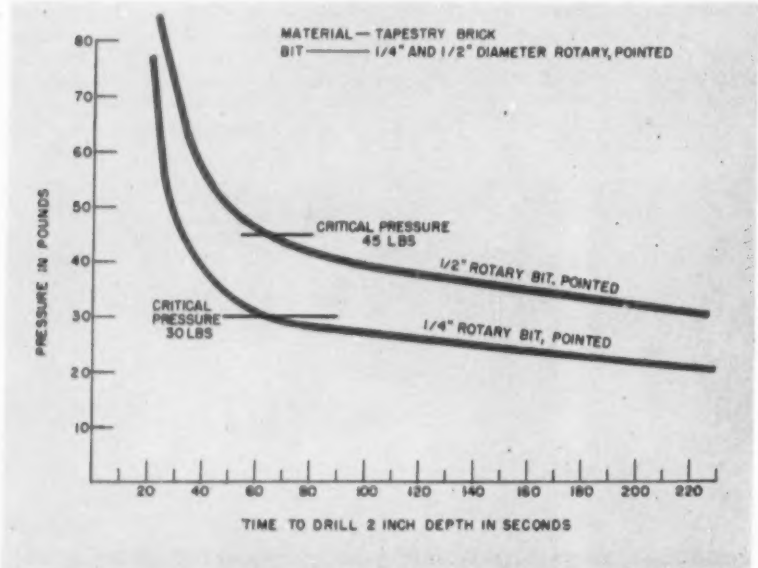


Fig. 2. Critical pressures for drilling in brick with pointed carbide tipped bits

TO DRILL masonry material with a rotary bit, pressure is required. The question is, how much pressure? If a rotary bit is used to drill a given piece of masonry at various pressures, it will be noticed that above a particular load any increase of pressure will give sharp increases in rates of penetration. Below this critical pressure, any change in pressure affects rate of penetration only slightly. Figure 1 shows this effect on a 1½ in. rotary core-type bit in a hard concrete. The critical pressure is above 200 lb, and in this particular case a pressure of 350 lb would be the lowest practical working pressure.

This critical pressure apparently marks that mysterious zone between cutting and rubbing or abrading. This is further supported by the fact that a bit operated below the critical pressure dulls much more rapidly than a bit operated above the critical. The critical pressure is therefore the lowest pressure at which a rotary bit actually cuts.

Critical Pressure

Naturally, the critical pressure will depend on the hardness of the material. For a ¼ in. diameter pointed bit, it may range from about 30 lb in soft common brick to about 175 lb in extremely hard green marble. In referring to critical pressure, reference is generally made to external load or force which is applied to the drill and bit.

Obviously, a bit of large diameter requires a greater external pressure to bring tip pressure within the cutting range. This is the reason why the bit diameters are so important in selecting the type of bit to be used in drilling a particular material. Figure 2 shows the effect of pressure, as well as diameter, on the time required to drill a 2 in. deep hole in tapestry brick. The two curves represent ¼ in. and ½ in. diameter bits. The ½ in. bit shows a critical pressure of about

*Executive Vice-President and †Development Engineer, New England Carbide Tool Co.

45 lb — the ¼ in. bit about 30 lb.

Some idea of the variation of critical pressure with diameter in a hard concrete may be had from Fig. 3. The effect of increasing diameter on the critical pressure is clearly indicated.

Since the tip pressure is distributed over the entire area of the cutting edge of pointed type or core type bits, by distributing it to best advantage, the critical pressure can be reduced. This explains why a core-type bit operates at lower critical pressures than the pointed bits. It is more efficient to apply tip pressures at a greater distance from the center of the tool. By removing the center of the bit, the load will be distributed over more effective tip areas in a core bit design. A ¼ in. pointed type bit has a critical pressure in glazed vitreous tile of 75 lb. A ¼ in. core design bit has a critical pressure in the same material of between 55 and 60 lb. This manifests itself in much longer bit life (three to five times in this material) and higher rates of penetration for the core design bits as compared to the pointed type of tool. For this reason a pointed bit above ¾ in. in diameter should not be used except in the softest materials.

Sharpening

The concept of critical pressure also explains the necessity for sharpening rotary bits at the correct time. As the bit dulls, the critical pressure requirement increases. When this happens, accelerated dulling will take place — the bit is rubbing, rather than cutting — and due to the heat developed, serious tip breakage may result from the severe stresses.

The concept of critical pressure thus explains:

1. Why there is a practical diameter limit for a given type of bit.
2. Why failure to sharpen at the proper time can cause tip breakage.
3. Why core bits are superior in performance to pointed bits.
4. Why, for the most efficient application of a rotary bit, a pressure well above the critical pressure should be applied.

Having established the particular critical pressure for the rotary bit, we must next decide on a suitable electric drill rpm at which to run the bit.

RPM of Electric Drill

It has been fashionable for many years in applying rotary masonry bits to use a slow-speed electric drill. Many users have gone to additional expense to convert standard-speed drills to slow-speed drills. Perhaps a little data will demonstrate the actual effect of drill rpm on bit performance.

Figure 4 illustrates what is to be expected — operation at higher rpm gives higher rates of penetration. From this data, however, it appears that there is a particular rpm above which little is to be gained in rate of penetration. This point may be considered the optimum rpm, and is close to the maximum practical rate of penetration which can be obtained by increasing drill rpm.

This may be considered the optimum rpm because of two reasons: it is the rpm at which bit life is longest; and second, it is the rpm at which the maximum rate of penetration is obtained for power delivered to the bit by the electric drill.

It should be emphasized, however, that determining the actual drill rpm at which to operate is always a secondary matter compared to the critical pressure. Critical pressure comes first. An optimum rpm does not exist below this critical pressure; at lower pressures (in the rubbing zone where drilling action is primarily frictional) any increase of drill rpm will cause accelerated dulling of the tip. Above *the critical pressure*, however, the higher the drill rpm up to the optimum, the greater the drilling efficiency.

SERIES TO BE REPRINTED

This article is the second in a series in which we are explaining the basic principles and latest developments in the field of concrete and masonry drilling. Last month we described how the properties of concrete and masonry affect carbide tipped bit design. In this month's issue the speeds and pressures to use for fast drilling are discussed. Next month we will explain how to choose the right bit and drill for each job, and the last article in the series will discuss hammer bits and their applications. When these four articles have been published, they will be reprinted. If you are interested in receiving a copy of these reprints when they are ready, write to the Editor, POWER ENGINEERING, and request that your name be added to the mailing list we are compiling.

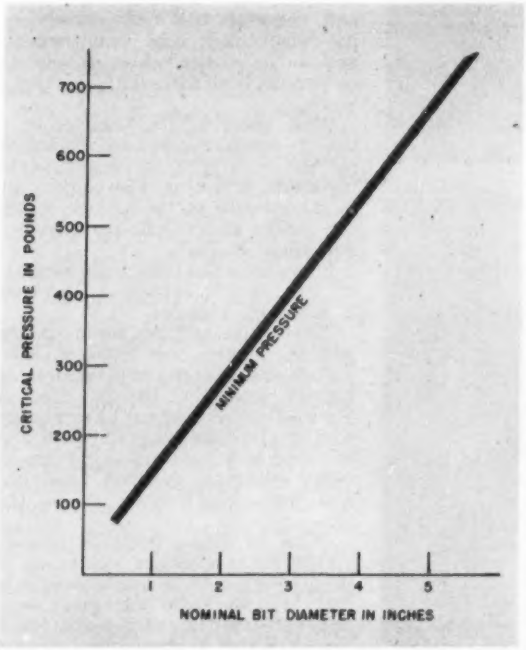


Fig. 3. Effect of diameter on critical or minimum pressure

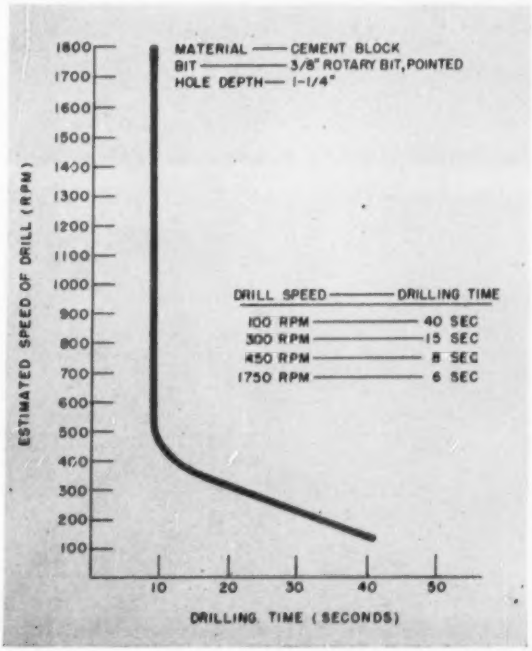


Fig. 4. Shows variation of rate of penetration with rpm

Hydro-Quebec studied service center practice all over Canada and the United States before building, on the island of Montreal, this example of what a good utility service center should be

Fig. 1. Aerial view of the new service center, showing easy road and rail access

Latest Thing in Utility Service Centers

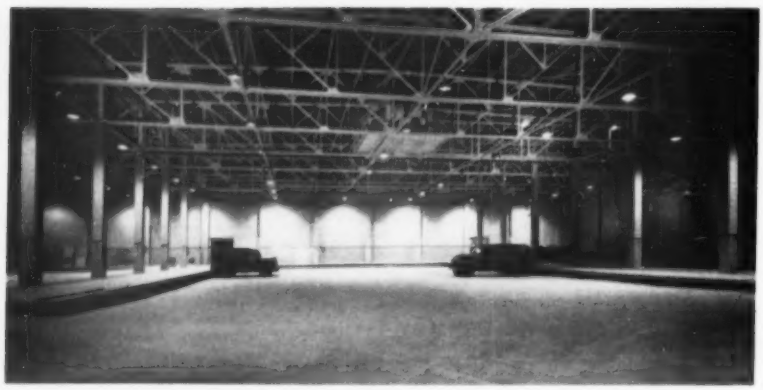


Fig. 2. Part of garage loading area. Note exhaust fume outlets beneath platforms

Fig. 3. Loading truck with meters. Trolleys bring meters straight from stores

NEW SERVICE CENTER of the Quebec Hydro-Electric Commission is probably the most advanced public utility service center in North America today. Though every utility will have some problems peculiarly its own, most of Hydro-Quebec's operations are typical of those carried out by any utility, large or small, and we present this review of the main features of this installation as a model of the last word in modern service center design and operation.

First of all, for those who are not familiar with utility operation, what is a service center and what tasks does it have to perform?

The main function of a utility is to provide uninterrupted power to its customers. Any customer reporting trouble must receive immediate attention. Thus there has to be some central point where complaints and inquiries can be received, where trained men are available at a moment's notice and where they can pick out the equipment and material they need to deal with an emergency. A service center houses the staff receiving these complaints and inquiries, the men who do the repairs, the equipment they use, and the vehicles that take them and their equipment out on the job.

Stores

Since so much equipment and material for emergencies has to be stored in the service center, it is usually found most convenient to store in the same place the rest of the equipment and materials the utility needs for its construction and maintenance, and so the service center usually incorporates both main and emergency stores.

Since most of the vehicles of a utility are occupied on customer service, or carrying stores and working crews, it is also most convenient to incorporate in the service center the garage and vehicle maintenance and repair shops.

So we have the three main sections of the service center: 1. Service, 2. Stores, 3. Vehicles.

Most utilities have some system whereby meters are removed from service and checked and repaired at regular intervals. In the case of Hydro-Quebec, Federal Law requires that this be done every six years, and so there is a continuous process of meter changing, checking, repairing, and replacement going on all the time.

With so many facilities concentrated in the service center, it is usually found to be most efficient to include in the same place such items as general machine shop work, transformer testing, salvage collection, and other miscellaneous operations. Hy-

dro-Quebec also distributes gas to its customers, and in addition to installing and repairing the meters, they manufacture them in the Center.

To carry out all these operations in one location, a large staff is needed. Hydro-Quebec has over a thousand at their new Center. This results, of course, in the need for facilities such as wash rooms, cafeteria, medical services, etc.

Since a utility is constantly faced with the problem of training new men, both in the trades and in driving, and since there is a concentration of skill in the service center, it is usually found convenient to make it a training center as well.

These are the things a service center tries to do. Let us now see how they are being done by Hydro-Quebec in Montreal.

The main part of the Commission's load is c ncentrated in the Island of Montreal. The new service center is located almost exactly at the geographical center of the Island. Few service centers in the country can pass this first test alone — to be located at the center of their operations. Figure 1 shows an aerial view of the center.

All facilities are housed in one fine looking building, 720 ft by 600 ft, mostly single story but with part in two stories containing the general office area, training school, cafeteria and auditorium. Nearly all equipment is stored inside, but there is an outdoor storage area for poles, piping and a few items not affected by bad weather. The whole area has easy approaches for vehicles from all directions and a railroad spur-line to bring in heavy equipment.

We will now describe the main features of each part of the service center.

Garage

The garage, with an area of 140,000 sq ft with room for as many as 300 vehicles at a time, is divided into three main sections:

a. A parking space, free of pillars, for light vehicles; equipped with wash stands and lubritorium.

b. Five parking-loading bays, adjacent to the stores, for heavy trucks and smaller panel models. One of these bays is shown in Fig. 2.

c. A repair shop with all equipment needed for complete overhaul of vehicles except engine rebuilding.

Protection of employee health, provision for their safety, improvement in working conditions and increase in productive efficiency governed the design and equipment of the garage.

A tile wall separates the repair shop from the remainder of the garage. Thus, drafts are eliminated and heat control is facilitated so that a temperature of 65 F may be maintained. Air changes are made several times an hour.

Fluorescent lighting provides a uniform 30-ft candle intensity. One of the most noticeable features of this whole service center is the excellent high level illumination throughout.

Fumes from running motors are sucked through grilled openings in the loading platform near the floor and rise to the roof through separate local exhaust stacks. Floor drains discharge into oil separators before entering the sewer system. Great importance is attached to cleanliness in the whole garage operation, and instead of the usual greasy and dirty floors to be found in most garages, the floors here are always perfectly clean and dry. All floors are sloped to drain so that no water or oil accumulates.

Garage doors are opened by electrically actuated treadle plates operated by a car wishing to enter or leave the building. A photo-electric cell close to the door provides protection against premature closing. Under-sill heating coils prevent accumulation of snow and ice.

A great deal of time has been saved on car washing by painting the cars with a particular paint and installing the car washer shown in Fig. 6. The washer makes one pass over the car with hot water, then one with a detergent, then two more passes with hot water. Then the windows are cleaned by hand and the car is finished. The particular paint is selected so that the car will dry without marks or smears after this rapid washing treatment, in the dust-free parking area of the garage.

Service

As mentioned at the beginning of this article, part of Hydro-Quebec's steady work is checking and replacing electric meters. In the new service center, loading and dispatching trucks now takes 25 per cent less time than it did before and the meter department handles 30 per cent increase in volume with substantially lower unit costs. Requisitions for the meters for a particular vehicle go to the stores the day before they are required by the truck. In the stores they are loaded on the triangular shaped trolley shown in Fig. 3. The trolley is made of sheet steel, with a number of hooks on which the meters are hung. This is an excellent way to carry the meters, being much easier than the old method of laying them on shelves where they easily became damaged.

Each trolley has marked on it the number of its particular truck and the name of the driver. When ready the trolley is wheeled to the garage where it is placed on the loading platform opposite its vehicle's allotted

Fig. 4. Part of meter test department. Trolleys make meter handling quick and safe

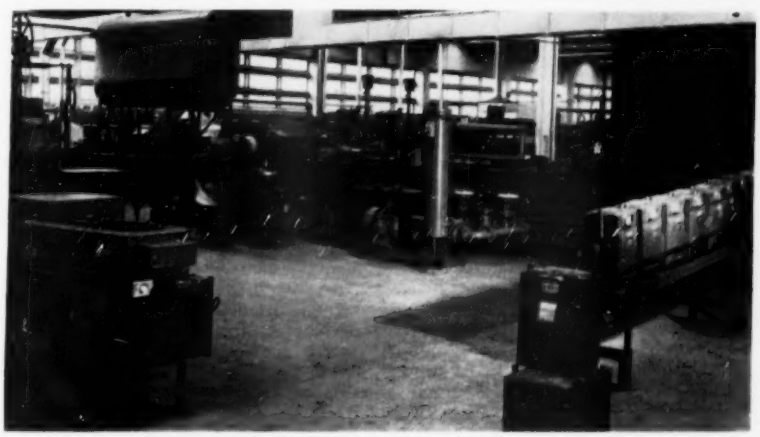


Fig. 5. Part of the gas meter manufacturing department at the service center

Fig. 6. After spraying cars dry without rubbing. Special paint prevents smearing

Fig. 7. All the service center shops are as unusually light and clean as this forge

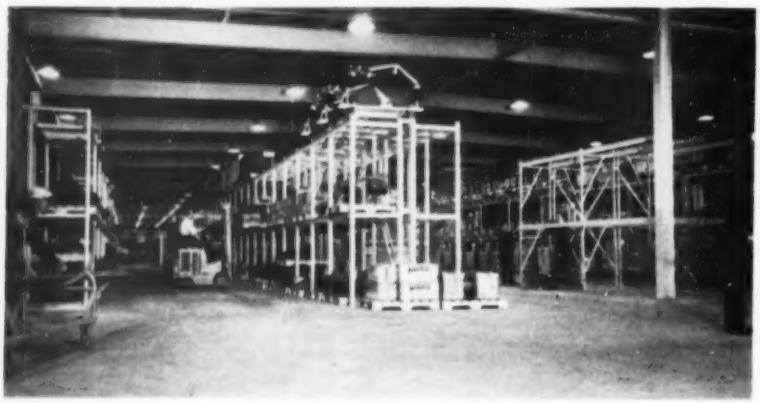


Fig. 8. Part of stores, showing cleanliness, good lighting, and maneuvering space

parking place. When the vehicle comes in, the driver just transfers the meters from the trolley to his truck. Thus intermediate handling is reduced to a minimum, much time is saved, and the meters suffer much less damage than with previous methods. Part of the testing department for electric meters is shown in Fig. 4.

Much the same system is in operation for gas meters, the only difference being that the gas meters have a different type of trolley to suit their size and shape.

Hydro-Quebec does not fabricate electric meters, but repairs, calibrates and inspects them. Meters are decontaminated before entering the shop and are repaired and calibrated before Federal Government inspection and sealing. They are then placed in the stores where they await requisition by the Installation Division.

General Shops

The general service shops in the service center occupy 32,000 sq ft. They are well lighted at an even 30-ft candles, as is the whole service center and they are equipped with forced mechanical ventilation permitting four air changes per hour.

Up-to-date machinery permits salvage operations; copper, tin and plumbing work; street light testing and repair; truck body building and repair; fitting, chemical and carpentry work; plant maintenance; the construction of concrete blocks, and coating and wrapping steel piping. Most of the shops, as with any utility, are concerned more with maintenance and repair than with production. The wood block floor reduces vibration and makes working more comfortable and the structural glazed tile walls provide good lighting and easy maintenance.

This is a good opportunity to comment on the amazing cleanliness of the entire service center. Right from the start, the chief engineer, J. H. Wheatley and his assistant, F. Dugal, have insisted on absolute cleanliness all the time. The results can be seen in some of the illustrations. Take Fig. 7 for example, and compare this clean, well lit forge with the normal dark, dirty condition of most forges. The same applies to all the other shops in the center. Not the least of the advantages of such cleanliness is reduced fire hazard.

All air entering the service center is filtered and this precaution is surprisingly effective in reducing the amount of dirt entering the building. Hydro-Quebec has found that one maintenance man per acre of floor area is quite enough to keep the building spotlessly clean.

Gas Meter Shop

New methods of manufacture and repair adopted by Hydro-Quebec have increased the quantity of gas meters made, improved the quality of both new and reconditioned meters, and lowered unit costs.

At the service center 12,000 meters are manufactured and 72,000 meters repaired annually. The shop and store area for gas meters occupies a total of 27,000 sq ft. Before dismantling, the meters are processed through a paint stripping machine. There is also a separate machine for re-oiling diaphragms. Meters are inspected automatically to determine any leakage and a manometer attached to each meter shows any leak by recording loss of pressure. Tested for accuracy and their tops soldered, the meters are carried on a conveyor to the automatic degreasing machine, the paint sprayer, and the infra-red drying furnace. See Fig. 5.

Power House

A very compact boiler house provides the service center with heat and power. Two 12,000 v circuits feeding an indoor sub-station supply the service center with electric power and a 13,000 kw electric boiler provides steam heat. A gas-fired boiler serves as a standby. A 50-kw gasoline engine driven generator is available for emergency lightings if the regular supply fails.

Detect Recirculating BF Pump Load-Drop Cavitation Mathematically

Sudden load-drop occasionally leads to a set of conditions causing pump cavitation. A preceding article is concerned with the prediction of those conditions in non-recirculating feedwater systems. This second article shows how to predict cavitation conditions in recirculating-type boiler feedwater pumps

By DR. S. BARON *

BASICALLY, the prediction of load-drop cavitation conditions in boiler feed pumps requires: (1) that the pressure decay schedule for the deaerating heater be calculated and plotted for significant time points between load drop and re-establishment of equilibrium at the lower load; (2) that the feedwater storage tank temperatures corresponding to those time points be determined; (3) that the time required for water to travel from the storage tank to the pump inlet be calculated; (4) that this time be added to the previously-determined significant time points; (5) that the required NPSH for the feed pump be determined for those time points established in step (4), which means for the temperatures established in step (2); and (6) that the heater pressure required to provide the NPSH values obtained in step (5) be calculated and plotted against the time points obtained in step (4), the curve being plotted on the same chart as the curve in step (1).

Actual Required Pressure

These steps will result in two distinct curves, one representing the actual heater pressure-vs-time conditions during load drop and the other representing required heater pressure-vs-time conditions for the same interval. Where the "actual" curve falls below the "required" curve, cavitation and its associated ills can be expected. This procedure was followed in a preceding article (May 1954 issue, page 69) for non-recirculating pump systems; essentially the same procedure is applicable to recirculating pump systems, but it requires that modifications be made to accommodate the effects of recirculating flow. This article presents such a modified analysis.

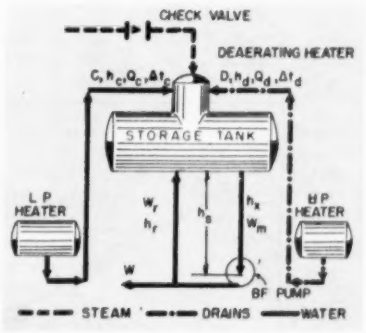


Fig. 1. Recirculating pump diagram relating system components to factors in each area. See Table I for the legend

Significant time points referred to in step (1) would be the residence times for water flowing through the condensate, drains and suction piping, as well as the time required to re-establish equilibrium at the lower load. These are designated as Δt_c, Δt_D, Δt_W, and Δt_F, respectively. Additional time points are chosen arbitrarily to give additional construction points for the two curves. (See the preceding article for a more complete discussion of residence times.)

Recirculation of water through the boiler feed pump, for any reason, has the effect of decreasing residence time of water in the pump suction piping — assuming that the pipe dimensions and the boiler feed rate remain the same. This decrease in residence time results from the higher pumping rate necessary to provide both the recirculating flow and the required boiler feed.

*Burns and Roe, Incorporated, Engineers and Constructors, New York, N. Y.

Factor	Source (See Notes)	Description
Q_D	1	Volume of drain piping from h-p heater following deaerator, to the deaerator (cu. ft).
Q_c	1	Volume of condensate piping from l-p heater before the deaerator, to the deaerator (cu. ft).
Q_W	1	Volume of suction piping from deaerating heater storage tank outlet to BF pump inlet (cu ft).
Q_S	1	Volume of water in storage tank (cu ft).
D	2	Drain flow from h-p feed-water heater (lb per hr).
C	2	Condensate flow from l-p heater to deaerating heater (lb per hr).
W	2	Feedwater flow to boiler (lb per hr).
W_R	2	Recirculating flow back to deaerating heater (lb per hr).
H	2	Enthalpy gain of water passing through pump (Btu per lb).
h_D	2	Enthalpy of h-p heater drains (Btu per lb).
h_c	2	Enthalpy of condensate (Btu per lb).
h_s	2 and 5	Enthalpy of feedwater in storage tank (Btu per lb).
R_S	4	Density of feedwater in the storage tank (lb per cu ft).
P_a	5	Heater pressure, actual or required as noted (psia).
P_{vp}	4	Vapor pressure of feedwater at BF pump inlet (psia).
NPSH	3	Net positive suction head required (ft).
h_{SI}	1	Static head at pump inlet less pressure drop in suction piping (ft).

General Subscripts:
G = High-load condition.
L = Low-load condition.
c = Condensate condition.
D = Drains condition.
R = Recirculating water condition.

Notes: Sources of data.
1. Data from plant layout drawings.
2. Data from plant feedwater heat balance.
3. Data from pump performance information.
4. Data from saturated steam tables.
5. Calculated (see Table II).

Table I. Factors used in calculation of pressure decay in recirculating fw systems. Source of data is given in notes

. . . Recirculating BF Pump Cavitation

Table II. Recirculating system pressure decay equations applicable when residence time Δt_D is longer than time Δt_c

Equation 1. Enthalpy in storage tank from $t = 0$ to $t = \Delta t_c$ expressed in Btu per lb. (At $t = \Delta t_c$, $h_s = h_{sc}$.)

$$h_s = \left(h_{sc} - \frac{K_2}{K_1}\right)e^{-K_1 t} + \frac{K_2}{K_1}$$

Equation 2. Enthalpy in storage tank from $t = \Delta t_c$ to $t = \Delta t_D$ expressed in Btu per lb. (At $t = \Delta t_D$, $h_s = h_{sD}$.)

$$h_s = \left(h_{sc} - \frac{K_3}{K_1}\right)e^{-K_1 \Delta t'_D} + \frac{K_3}{K_1}$$

in which $\Delta t'_D = \Delta t_D - \Delta t_c$.

Equation 3. Enthalpy in storage tank from $t = \Delta t_D$ to $t = \Delta t_F$ expressed in Btu per lb. (At $t = \Delta t_F$, $h_s = h_{sL}$.)

$$h_s = \frac{\left(h_{sD} - \frac{K_4}{K_1}\right)e^{-K_1 t}}{e^{-K_1 \Delta t_D}} + \frac{K_4}{K_1}$$

Equation 4. Simplified equation for enthalpy in storage tank throughout pressure decay, or from $t = 0$ to $t = \Delta t_F$, expressed in Btu per lb.

$$h_s = \left(h_{sc} - \frac{K_4}{K_1}\right)e^{-K_1 t} + \frac{K_4}{K_1}$$

(Not applied in the example worked in this article.)

Equation 5. Factor expressed as reciprocal of hour.

$$K_1 = \frac{(D_L + C_L)}{Q_S R_S}$$

Equation 6. Factor expressed as Btu per lb-hr.

$$K_2 = \frac{(C_L h_{cL} + D_L h_{DL} + W_R H)}{Q_S R_S}$$

Equation 7. Factor expressed as Btu per lb-hr.

$$K_3 = \frac{(C_L h_{cL} + D_L h_{DL} + W_R H)}{Q_S R_S}$$

Equation 8. Factor expressed as Btu per lb-hr.

$$K_4 = \frac{(C_L h_{cL} + D_L h_{DL} + W_R H)}{Q_S R_S}$$

Equation 9. Required heater pressure expressed in psia.

$$P_s \text{ (required)} = (\text{NPSH} - h_{sl})\frac{R}{144} + P_{vp}$$

Equation 10. Residence time of condensate piping expressed in hours.

$$\Delta t_c = \frac{Q_c R_{cL}}{C_L}$$

Equation 11. Residence time of drains piping expressed in hours.

$$\Delta t_D = \frac{Q_D R_{DL}}{D_L}$$

Equation 12. Residence time of feed pump suction piping expressed in hours.

$$\Delta t_W = \frac{Q_W R_S}{W_R + W}$$

Recirculation has the additional effect of introducing a third flow into the heater, and this inflow will be warmer than the stored water. Recirculated water entering the heater has left the heater at a time when the stored water was nearer its initial high-temperature condition, and it has also picked up enthalpy by passing through the pump and the piping.

These conditions combine to maintain a slightly higher heater pressure in the early stages of pressure decay, thereby minimizing the difference between actual and required heater pressure. In some cases, this may be sufficient to eliminate the cavitation condition present in an identical system without recirculation. That this cannot be offered as a general rule, however, is illustrated by the following example which assumes a system identical to that in the first of these two articles, but with recirculation.

Equations required to carry out steps (1) through (6) are listed and identified in Table II, while the legend of symbols and factors appears in Table I. It is important to note that these equations are modified to apply to recirculating systems and should not be used when calculating cavitation conditions for systems without recirculation. Remedial actions to offset cavitation are generally interchangeable, and these remedies were listed and discussed in the preceding article.

Table III. Results of pressure decay calculations in recirculating pump example

t (hrs)	h_s Btu/lb	P_s (psia)	P_s (actual) (psia)	P_{vp} (psia)	T (F)	R (lb/cu ft)	Required NPSH (ft)	Required P_s (psia)	$t + \Delta t_W$ (hrs)
0	250	50.0	50.0	50.0	281.0	57.8	20	42.0	.0469
.0356	245.8	46.8	45.2	48.4	279.0	58.0	20	40.3	.0825
.0469	242.6	44.5	42.9	46.1	275.9	58.1	20	38.0	.0938
.150	217.8	29.5	27.9	31.1	252.4	58.7	18	22.1	.197
.259	198.3	20.8	19.2	22.4	234.0	59.2	17	12.9	.306
.350	184.7	16.1	14.5	17.7	221.5	59.6	16	7.9	.397
.455	173.0	12.8	11.2	....	.....	....	..	...	...

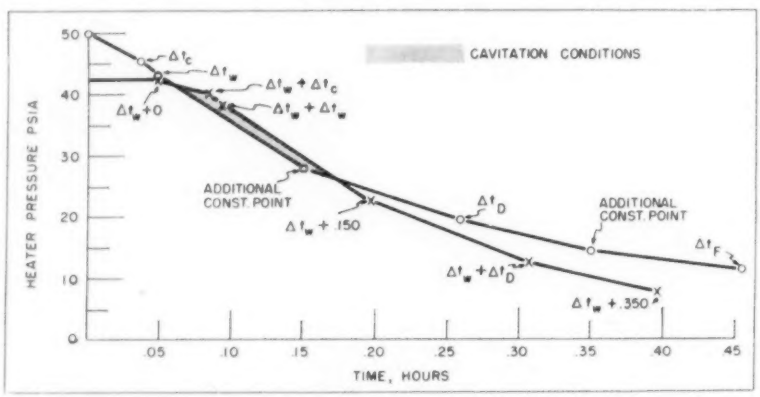


Fig. 2. Results of example plotted to show actual pressure below required (shaded)

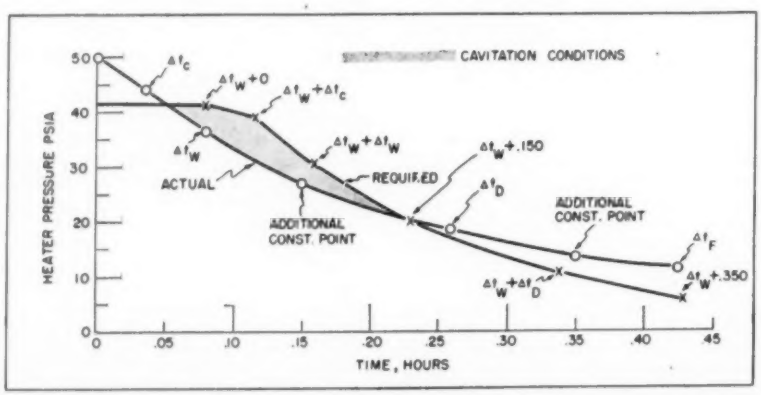


Fig. 3. Without recirculation, the pressure deficiency is greater and lasts longer

Table IV. Example showing the application of equations in Table II to cavitation prediction problem for recirculating pump

EXAMPLE: A 40–44 MW turbine generator, 1250 psig, 950 F throttle conditions, operating at 44,000 kw, underwent a sudden load drop to 10,000 kw. Its feedwater system recirculates a constant flow. Heat balances for the system provide the following data:

Fluids	Flow at 10 MW (lb per hr)	Enthalpy at 44 MW (Btu per lb)	Enthalpy at 10 MW (Btu per lb)
Condensate	$C_L = 80{,}000$	$h_{sG} = 198$	$h_{sL} = 132$
Drains	$D_L = 8{,}000$	$h_{DG} = 260$	$h_{DL} = 183$
Feedwater	$W_L = 88{,}000$	$h_{sG} = 250$	$h_{sL} = 173$
Recirculation	$W_R = 60{,}000$	$H = 6$	$H = 6$

From the layout drawings, the following data are known: (refer to Table I for meaning of symbols.)

$Q_c = 48$ cu ft; $Q_D = 36$ cu ft; $Q_W = 120$ cu ft; $Q_S = 500$ cu ft; $h_S = 40$ ft; level of water in storage tank = 8 ft. Assume average density constant and an average between initial and final conditions.

CALCULATIONS: With the preceding data, perform the following stepwise calculations: (Numbered steps do not refer to those listed in the first paragraph of this article.)

Step 1. Residence times Δt_c, Δt_D, Δt_W, and values for $\Delta t'_D$ are found as follows:

A. $$\Delta t_c = \frac{Q_c R_{cG}}{C_L} = \frac{48\left(\frac{1}{0.01684}\right)}{80{,}000} = 0.0356 \text{ hr}$$

B. $$\Delta t_D = \frac{Q_D R_{DG}}{D_L} = \frac{36\left(\frac{1}{0.01737}\right)}{8{,}000} = 0.259 \text{ hr}$$

C. $$\Delta t_W = \frac{Q_W R_S}{W_L + W_R} = \frac{120\left(\frac{1}{0.01729}\right)}{148{,}000} = 0.0469 \text{ hr}$$

D. Additional residence time of suction piping over the condensate piping $= \Delta t'_W = \Delta t_W - \Delta t_c = .0469 - .0356 = 0.0113$ hr

E. Additional residence time of drains piping over the condensate piping $= \Delta t'_D = \Delta t_D - \Delta t_c = .259 - .0356 = 0.223$ hr

Step 2. Find the average density of feedwater between initial and final enthalpies ($h_{sG} = 250$ Btu per lb and $h_{sL} = 173$ Btu per lb) as follows:

$$R_S = \frac{\left(\frac{1}{0.01667}\right) + \left(\frac{1}{0.01727}\right)}{2} = 59.0 \text{ lb per cu ft}$$

Step 3. Find the values of K_1, K_2, K_3, and K_4 as follows:

A. Constant $$K_1 = \frac{(D_L + C_L)}{Q_S R_S} = \frac{(80{,}000 + 8{,}000)}{500 \times 59.0} = 2.98\left(\frac{1}{\text{hr}}\right)$$

B. Factor $$K_2 = \frac{(C_L h_{sG} + D_L h_{DG} + W_R H)}{Q_S R_S} =$$

$$= \frac{(80{,}000 \times 198) + (8{,}000 \times 260) + (60{,}000 \times 6.0)}{500 \times 59.0} = 620 \text{ Btu per lb-hr}$$

C. Factor $$K_3 = \frac{(C_L h_{sL} + D_L h_{DG} + W_R H)}{Q_S R_S}$$

$$= \frac{(80{,}000 \times 132) + (8{,}000 \times 260) + (60{,}000 \times 6.0)}{500 \times 59.0} = 441 \text{ Btu per lb-hr}$$

D. Factor $$K_4 = \frac{(C_L h_{sL} + D_L h_{DL} + W_R H)}{Q_S R_S}$$

$$= \frac{(80{,}000 \times 132) + (8{,}000 \times 183) + (60{,}000 \times 6.0)}{500 \times 59.0} = 420 \text{ Btu per lb-hr}$$

Step 4. Find the mean enthalpies of condensate and drains mixtures at $t = 0$, $t = \Delta t_c$, and $t = \Delta t_D$ as follows:

A. $\frac{K_2}{K_1} = \frac{620}{2.98} = 208$ Btu per lb

B. $\frac{K_3}{K_1} = \frac{441}{2.98} = 148$ Btu per lb

C. $\frac{K_4}{K_1} = \frac{420}{2.98} = 141$ Btu per lb

Step 5. Find the mean enthalpy in the storage tank at $t = \Delta t_c$, $t = \Delta t_D$ and $t = \Delta t_W$ as follows:

A. At $t = \Delta t_c$, $h_{sc} = \left(h_{sG} - \frac{K_2}{K_1}\right)e^{-K_1 \Delta t_c} + \frac{K_2}{K_1}$

$h_{sc} = (250 - 208)e^{-2.98 \times 0.0356} + 208 = 245.8$ Btu per lb

B. At $t = \Delta t_D$, $h_{sD} = \left(h_{sc} - \frac{K_3}{K_1}\right)e^{-K_1 \Delta t'_D} + \frac{K_3}{K_1}$

$= (245.8 - 148)e^{-2.98 \times 0.223} + 148 = 198.3$ Btu per lb

C. At $t = \Delta t_W$, $h_{sW} = \left(h_{sc} - \frac{K_3}{K_1}\right)e^{-K_1 \Delta t'_W} + \frac{K_3}{K_1}$

$= (245.8 - 148)e^{-2.98 \times 0.0113} + 148 = 242.6$ Btu per lb

Step 6. Find the total time (Δt_F) required for the deaerating heater pressure to decay to the low-load condition. Apply Equation 3, Table II, letting $h_s = h_{sL} = 173.0$ Btu per lb and $t = \Delta t_F$:

$$h_{sL} = \frac{\left(h_{sD} - \frac{K_4}{K_1}\right)e^{-K_1 \Delta t_F}}{e^{-K_1 \Delta t_D}} + \frac{K_4}{K_1}, \text{ therefore}$$

$$173 = \frac{(198.3 - 141)e^{-2.98 \Delta t_F}}{e^{-2.98 \times 0.259}} + 141 = \frac{(57.3)e^{-2.98 \Delta t_F}}{e^{-0.7718}} + 141$$

or, $e^{+2.98 \Delta t_F} = 3.872$, or, $2.98 \Delta t_F (0.434) = 0.58794$

or, $\Delta t_F = 0.455$ hr

Step 7. To provide a fairly even distribution of data for charting across the full time scale, Fig. 2, solve Equation 2 for $t = 0.150$, and Equation 3 for $t = 0.350$, as follows:

A. If $t = 0.150$, $\Delta t'_D = 0.150 - \Delta t_c = 0.150 - 0.0356 = 0.1144$ hr

therefore, $h_s = (245.8 - 148.0)e^{-2.98 \times 0.1144} + 148 = 217.8$ Btu per lb

B. If $t = 0.350$, Equation 3 is written:

$$h_s = \frac{(198.3 - 141)e^{-2.98 \times 0.350}}{e^{-2.98 \times 0.259}} + 141 = 184.7 \text{ Btu per lb}$$

Step 8. Find the mean heater pressure (P_s) at each time point by entering the saturated steam tables with the mean heater enthalpies (h_s) for those times. Tabulated this information as shown in Table III.

Step 9. Find the heater pressure (P_a actual) at the different times by subtracting the pressure of the hydrostatic head (above the point at which the mean pressure P_s was determined) from P_s. In this case, the head factor is $\frac{8}{2} = 4$ ft, or 1.6 psia. Therefore, P_a actual $= P_s - 1.6$. Values are listed in Table III and are plotted against time in Fig. 2.

Step 10. Find the vapor pressure of water at the pump inlet (P_{vp}) for the different times by adding the pressure of the hydrostatic head to the values of P_s for the different times. Therefore, $P_{vp} = P_s + 1.6$. Values are listed in Table III.

Step 11. Find the temperature and density of water at the pump inlet for the different times by entering the saturated steam tables with the values of P_{vp} just obtained and finding the corresponding values. List these in Table III.

Step 12. Find the required heater pressures (P_a) corresponding to the temperatures just obtained by applying Equation 9, Table II, as follows:

A. At $t = 0$, temperature = 281 F, and from the performance curve of the pump in this example (not shown) it was found that the required NPSH for this temperature is 20 ft. Density (obtained and tabulated in Step 11) for this temperature is 57.8 lb per cu ft, and P_{vp} (obtained in Step 10) is 50 psia. Elevation $h_S = 40$ ft, from original data obtained from the layout drawings. Equation 8, therefore, is written:

$$P_a \text{ (required)} = (20 - 40)\frac{57.8}{144} + 50 = 42.0 \text{ psia}$$

B. Repeat this procedure for $t = 0.0356$, $t = 0.0469$, $t = 0.150$, $t = 0.259$, and $t = 0.350$, using data from the corresponding lines in Table III. Values of P_a (required) corresponding to these times in the left-hand column of Table III are calculated and listed. (The calculations are repetitive and are not shown here.)

Step 13. Since all values of P_a (required) are calculated on the basis of residence times at the heater, it is necessary to introduce the residence time in the suction piping (Δt_W) to make the data apply at the pump inlet. P_a (required), therefore, is plotted against $t + \Delta t_W$, which values are listed in the right-hand column of Table III.

Step 14. Two curves are now plotted on Fig. 2; one is P_a (actual) relative to time, and the other is P_a (required) relative to time. It will be noted that between $t = 0.058$ hr and $t = 0.170$ hr, the actual pressure is less than the required pressure; hence, cavitation conditions exist for that period of time.

Figuring Hot-Cold Ceilings

Increasingly popular is suspended ceiling which combines functions of radiant heating, radiant cooling, and acoustical control. Here are instructions showing you how to figure amount of heating and cooling piping you need for each ceiling

Heating Only....

1. Zone the building or space to be heated and proceed as follows in each zone.
2. Determine heat loss for each room to be heated.
3. Determine the area in sq ft for each room to be heated.
4. Determine panel demand for each room to be heated by dividing the heat loss by the total room area in sq ft.
5. Determine the circulating water mean temperature, assuming a 20 F temperature drop across each coil, required to satisfy greatest panel demand, with laterals spaced at 1 in. centers, from chart shown in Fig. 1.
6. Determine the ceiling area of laterals either 1 in. across centers or 2 in. across centers required to satisfy the heat loss, filling in balance of ceiling area, if any, with metal pan acoustic ceiling.

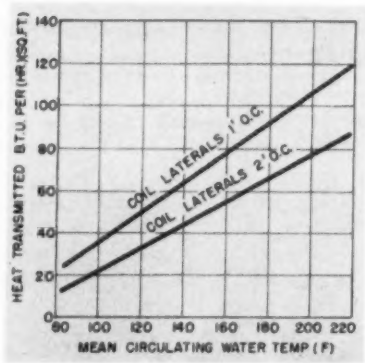


Fig. 1. Curves showing heat transmitted for different circulating water temps for coil laterals, at 80 F air temp and 80 F average uncooled surface temp

Cooling Only....

1. Zone the building or space to be cooled and proceed as follows in each zone.
2. Determine sensible heat gain for each room to be cooled.
3. Determine the area in sq ft for each room to be cooled.
4. Determine dewpoint from psychometric chart based on indoor design conditions. This fixes minimum inlet water temperature.
5. Determine absorption rate from chart in Fig. 2 at circulating water mean temperature, assuming a 5 F temp rise across each coil.
6. Determine the sensible heat absorbed by multiplying absorption rate by ceiling area.
7. If the sensible heat gain exceeds the sensible heat absorbed the difference must be handled by the ventilating system.

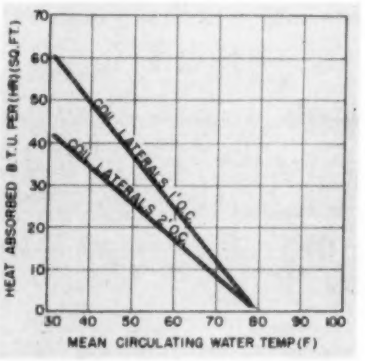


Fig. 2. Curves showing heat absorbed for different circulating water temps for coil laterals, at 80 F air temp and 80 F average uncooled surface temp

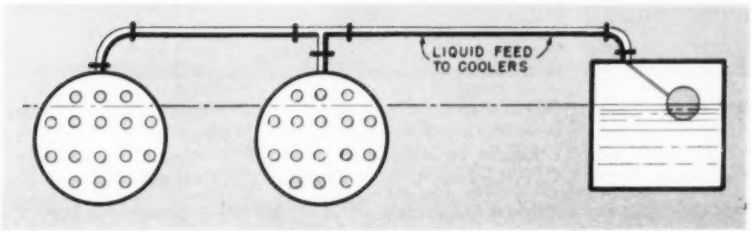
Heating and Cooling....

1. Zone the building or space to be heated and cooled and proceed as follows in each zone.
2. For maximum radiant cooling, all treated rooms must be covered with coils spaced with laterals at 1 in. centers.
3. Determine the heat loss for each room to be heated and cooled.
4. Determine the area in sq ft for each room to be heated and cooled.
5. Determine panel demand for each room to be heated by dividing the heat loss by the area.
6. Determine circulating water mean temperature, assuming a 20 F temperature drop across each coil required to satisfy greatest panel demand, with laterals at 1 in. centers, from chart shown in Fig. 1.
7. Determine the ceiling area, with laterals at 1 in. centers, required to satisfy the heat loss in all remaining rooms. The remaining ceiling area in each room should be covered by a coil which will be used for cooling only.
8. Determine the dewpoint from the psychometric chart based on indoor design conditions. This fixes the minimum inlet water temperature.
9. Determine the absorption rate from the chart in Fig. 2 at circulating water mean temperature assuming a 5 F temperature rise across each coil.
10. Determine the sensible heat absorbed by multiplying absorption rate by ceiling area.
11. If the sensible heat gain exceeds the sensible heat absorbed, the difference must be handled by the ventilating system.

These instructions outline methods of figuring these ceilings. If you want full size charts, complete instructions, or more information about this type of ceiling, write HOT-COLD CEILING on one of the prepaid post cards elsewhere in this issue and send it to us

Excess lubricating oil, insufficient liquid ammonia, omission of oil drains, and uninsulated hot pipelines all caused poor refrigeration and lower ice production. All of this means—

More Ways of Wasting Refrigeration Money



Low liquid level meant top tubes in coolers were uncovered. See text for details

By C. T. BAKER*

AN ICE-MAKING PLANT consumed 75 kwh per ton of ice produced. The plant was modern, and had been well designed and constructed, and should have produced ice for about 55 kwh per ton.

A complete check on operations disclosed some interesting situations. There were two freezing tanks side by side, each equipped with a shell and tube single-pass brine cooler. The tubes of each cooler were coated with ice resulting from low strength brine. Several drums of calcium chloride were required to bring the brine to the correct strength. Strengthening the brine did increase the rate of ice production but failed to supply the complete answer. When the coolers were tested for oil, it took nearly 5 hours of continuous draining to remove a two years' accumulation of compressor lubricating oil that had found its way into each of the coolers.

At first it was thought that poor piston rings were to blame, but they were found to be in good condition. Later it was discovered that high oil level was the cause of excess oil carry-over from the compressor crankcase.

The plant engineers had made it a point to carry the oil level in the crankcase several inches above the oil level mark of the machine manufacturers which was plainly indicated opposite the oil gage glass.

Dropping the oil level to the correct point overcame completely the carry-over problem. This is a good example of the money that can be lost just by careless operation.

Still another problem that seriously influenced plant capacity was the arrangement of the liquid feed to the coolers.

The float chamber controlling the supply of liquid ammonia to the coolers was set too low to completely flood the tube surfaces and the attempt to supply both coolers with one float expansion valve failed to maintain the liquid level high enough to cover the top row of tubes. The original hookup is shown above.

This problem was solved by providing a float chamber with float operated expansion valve on each cooler and locating each at an elevation that would insure flooded operation of the coolers. At the conclusion of the program of improvements, full plant capacity was easily produced with a power consumption of slightly over 57 kwh per ton.

Dairy Plant Troubles

It was difficult to maintain proper temperature in the several rooms of a modern dairy and it was also difficult to cool milk at the rate required for full station output.

The room temperature problem was solved by placing an oil drain on all unit coolers in use. Though these drains had been specified at the time the plant was installed, they had been left out by the mechanical contractor.

Tubular Coolers

Milk and chocolate mix were cooled over an atmospheric-type tubular cooler with ammonia as the cooling agent. Even at reduced cooling capacity it was difficult to cool the milk or the mix below 65 F.

Here again, no oil drain had been provided for removing oil accumulations from the cooler. After installing a suitable drain, several gallons of oil were removed from the lower section of the unit. In a search for the cause of the heavy oil carry-over it was traced to worn piston rings, a condition promptly corrected.

An ice plant, after several years of using central station power, installed an oil engine to drive their equipment. The plant was rated at 20 tons of ice per day. Shortly after the installation of the diesel engine, capacity began dropping off and by mid-summer the output was down to 17 tons per day.

In addition to driving one 9 x 9 and one 8 x 8 compressor, the engine also drove a 25 kw generator.

Most of the trouble in this plant was traced to high temperature air in the combination engine and tank room resulting from heat given off by the engine and the engine exhaust line.

The exhaust pipe between the engine and a point just beyond the building wall was placed in a concrete trench. Temperature measurements showed that the air passing from this trench through the steel cover grating was 170 F. Suction piping, uninsulated brine piping, and the freezing tank were all exposed to this heating influence.

The suction inlets and discharge outlets of the compressors were not equipped for determining the amount of superheat of the suction and discharge gas; but, in any event, both the ammonia suction gas and the cold brine line were absorbing large quantities of heat, all of which had to be handled by the compressors and which, of course, greatly reduced total plant output.

In addition, the freezing tank was also subject to a considerable heat gain from the same source.

Pipe line losses were greatly reduced by applying extra thick covering to both the brine and ammonia lines.

A couple of monitor type ventilators were placed on the roof, thus providing several air changes and materially lowering engine room temperatures.

It was recommended that the exhaust piping inside the engine room be insulated to reduce the heat released in this room.

The condensing pressure gage showed 225 psi until a thorough cleaning of the double pipe ammonia condensers and a complete purging of the system of air corrected this high condensing pressure situation. Ice production was soon raised to full rated capacity.

* Consulting Engineer

Fig. 1. Large audience of engineers listening to hydraulics forum shown in Fig. 2, as panel members discussed current pumping problems and pumps, resulting from constantly increasing demands for water throughout the United States

Fig. 2. Panel at hydraulic forum in action. L to r, standing: D. A. Rankin, F. M. Dawson, R. G. Folsom, G. A. Hathaway, L. Kessler, A. Hollander. Seated: P. F. Morgan, R. T. Knapp, C. P. Lindner, I. A. Winter, G. F. Wislicenus, J. W. Daily

Forum Covers Pumps and Water Supply

FAIRBANKS, MORSE & CO. formally dedicated its new centrifugal pump manufacturing plant at Kansas City, Kan. on May 19, 1954. In conjunction with this occasion, the company sponsored a hydraulics forum on May 20 at the Town House Hotel. Several hundred engineers (Fig. 1) from all over the country heard a panel of hydraulics authorities (Fig. 2) discuss pumping problems resulting from the increasing demand for water and the increasing scope and complexity of the water problems. Their discussion will be published and available later.

The visiting engineers inspected the new factory, saw the latest in production, machinery and foundry practice.

Lester B. Knight & Associates, Inc. were consultants on design and construction of the new plant which is located on a 38½-acre site.

Fig. 3. Propeller pump, 116 in. diameter, 360,000 gpm, 11.1 ft head, ready at Kansas City for flood control and irrigation project at Belle Glade, Florida

Fig. 4. This is the 20-in. model of the 116-in. pump of Fig. 3 under test

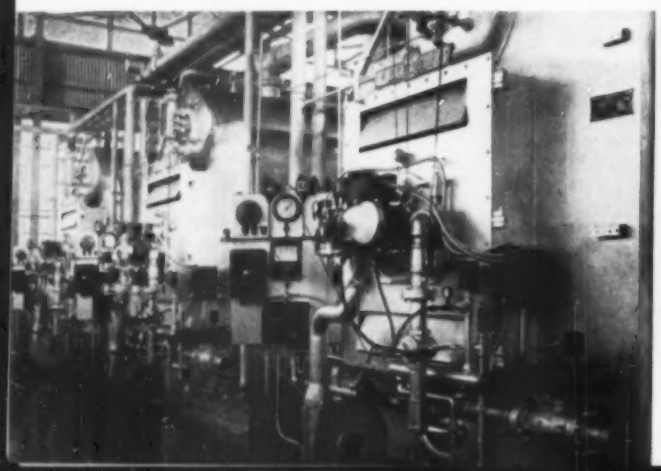


Fig. 5. Three Keystone oil-fired, automatic package water-tube steam generating units supply steam to the factory. Three 750-cfm compressors supply all plant air

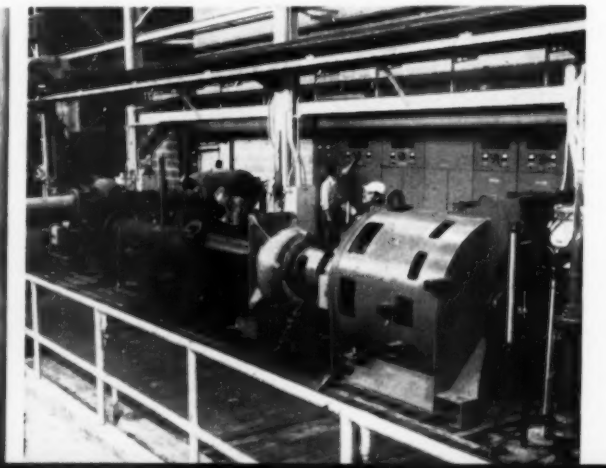


Fig. 6. Here is portion of F-M's experimental pump test floor in new factory. Across the aisle is production test floor; each pump is given an individual test before shipment

Written Examinations for Professional Engineers

By JOHN D. CONSTANCE *

STATE Registration Boards are with us to register persons competent to practice professional engineering and to refuse registration to those who are not competent. It is generally accepted that, in the majority of cases, the written examination is, for the present, the only way that will definitely make this separation of applicants for registration possible.

It was discovered that this avenue of approach was able to disclose not only the area of academic knowledge of the applicant but did surprisingly well, in the majority of cases, to establish the degree of judgment and perspective developed in the applicant after four years of academic training (or the equivalent), followed by four or more years of internship in the engineering office or on the job site.

Since 1931 various State Boards of Examiners have made an effort to create some uniformity in the types, quality and quantity of questions to be asked; and there has resulted a general trend toward such uniformity today. Uniformity in the written examination (and other requirements, too) is essential because of the matter of licensure by endorsement, so that the free flow of engineering talent and services across state lines may be facilitated.

Must Be Sampling Process

The general form for the written examination has become reasonably well standardized, some deviation occurring because of individual state prerogative. The examination must be a sampling process since it is impracticable to examine a candidate in every detail of the basic sciences and engineering principles, or in every phase of their application to actual problems. This sampling process must afford good distribution and should be of a character to determine ability to use the tools of the profession instead of mere memory tests. The written examination should be so well designed that it can be said that the Professional Engineer is paid for what he can do rather than for what examination he can pass.

In considering the written examination itself, let us first consider the types of questions asked. Usually, the written examinations given by Registration Boards are not of the type given to college students to ascertain if they have mastered a subject on which they had received class instruction. As previously indicated, by giving a written examination the Board tries to determine if a candidate really has the basic knowledge that an engineer should have, together with the experience that has taught him to use that knowledge practically and efficiently.

The Boards have recognized this need and have made it a rather common practice to divide their written examinations into two parts, given on succeeding days. This two-day examination divides readily into one day for the basic material to evaluate the candidate's knowledge of engineering fundamentals, and one day for applications to determine his ability to apply them and to determine the extent of his experience.

First Day's Questions

Practically all State Boards conform to the first day's questions as found by a special committee of the National Council of State Boards of Engineering Examiners (NCSBEE). These usually cover the basic subjects of mathematics, physical and applied sciences (statics, dynamics, fluid mechanics, thermodynamics, electrical principles and mechanical design). Some Boards prefer not to give questions that are purely mathematical, but follow a policy of depending upon the skill shown by the candidate in solving problems in economics, physics, chemistry, etc., to reveal his mathematical ability.

Here, for example, is a typical question given on the first day examination on general engineering theory and fundamentals: — "What percentage of CO_2 by volume is produced in the exhaust of an automobile engine operating on gasoline with a mixture of exact combining proportions? Assume gasoline to be octane, C_8H_{18}."

Such a policy, it is believed, permits a more efficient use of the examination time. Thus, the standard two full eight-hour day examination may be reduced to three four-hour examination periods, for example.

Second Day's Questions

However, for the second day it was found that some Boards had drifted far afield from the practical and had reverted to the theoretical questions that should have been asked on the first day. Problems for the second day should require the candidate to show proper judgment in selecting correct formulas, economical considerations and practical approaches. Problem wording and terminology should be so arranged that the candidate must call upon his experience to develop a solution.

After the first day's examination has tested the candidate's facility in mathematics and engineering theory the second day's questions may contain an "essay" type question or a critical description of a project on which the candidate has had some experience, so as to reflect his grasp of engineering principles more than any number of academic problems could ever do.

Essay-Type Example

Thus, for example: — "Give at least four different methods of removing dust particles from a gas and compare their engineering requirements. Given a gas of 50,000 cfm flow with 50 lb per min of a hygroscopic dust, averaging 10 microns size, at 200 F. and a dew point of 50 F., what method would you recommend and why?"

A fresh inexperienced candidate could not handle such problems, whereas a man with only a few years of field practice could readily handle them with ease.

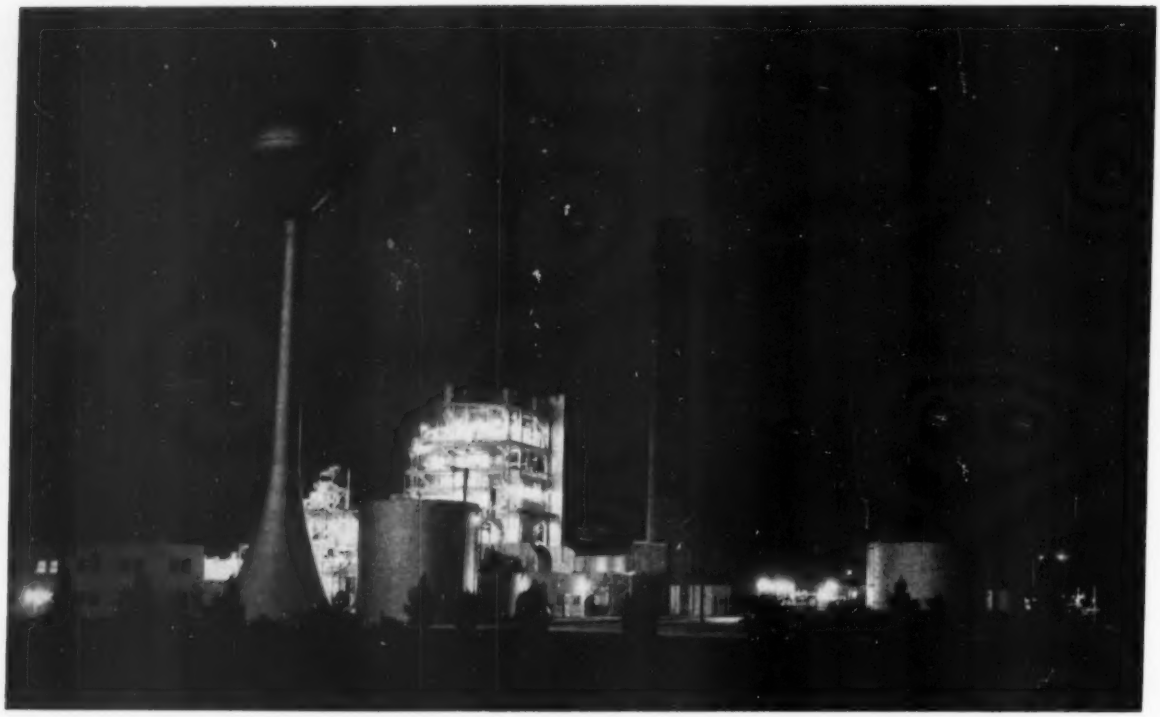
As for the quality of questions that are given, it must be kept in mind that the examination is given to candidates having minimum qualifications for registration; and questions should be asked accordingly. Most Board members try to visualize themselves as having the four years' minimum experience requirement, and ask questions they could have answered at that time.

Time to Answer

Now for the quantitative aspect of questions, most Boards are interested in asking questions that would not require too long to answer. Ordinarily, a question is supposed to require from one-half to three-quarters of an hour to answer. Some require less time than that to answer. Since in most cases all problems have equal value, long answers are not to be anticipated. In writing questions, thought should be given to the age of the candidate. As a man grows older he becomes more careful of his calculations or how he expresses himself. And this takes time. If such a person is given a problem within his line of experience and time to solve it, he would show superior ability.

What does the future hold for registration by written examination? More than two-thirds of all licensed engineers are now registered in states which require a written examination of not less than two days' duration as one of the qualifications for registration. This practice is spreading, and it is reasonable to expect that most engineers who expect to remain in engineering will some day be confronted with the necessity of taking the written examination for legal recognition.

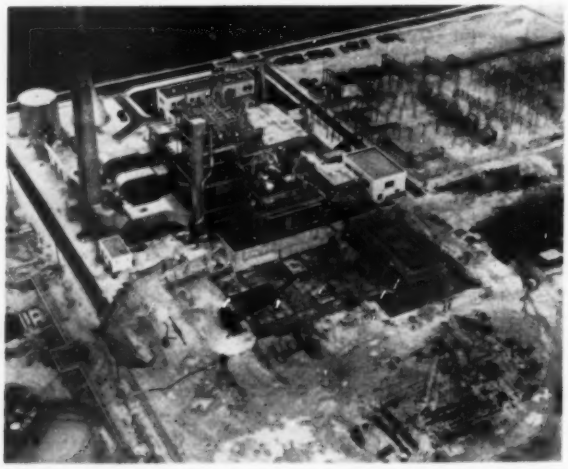
*Consulting Engineer, 625 Hudson Terrace, Cliffside Park, N. J.



Power Engineering's NEWS REEL

New Cutler Plant of the Florida Power and Light Co. proves that outdoor construction can be very attractive as well as practical. Its striking appearance in this photograph, taken at dusk, is due primarily to the exclusive use of aluminum paint on all exterior surfaces. Four units generating 160,000 kw are in operation while installation of units rated 80,000 and 135,000 kw is being pushed ahead for completion in 1955. A steam pressure of 1350 psi gives the plant the highest pressure in Florida, while the 135,000-kw unit will be the largest turbine-generator in Florida

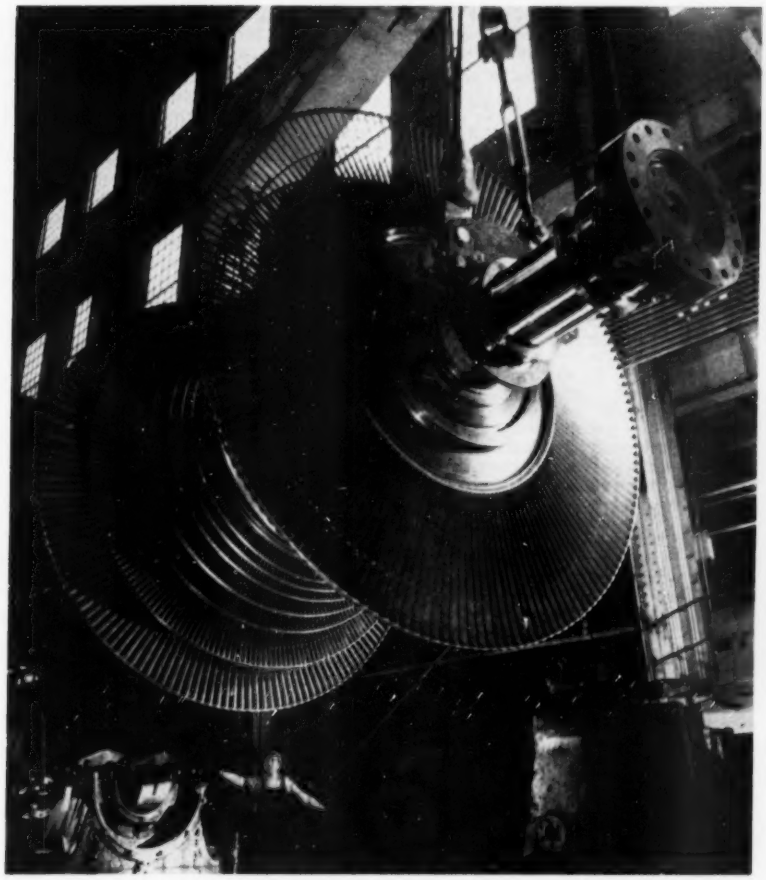
Fuel oil for new Cutler Plant is brought from Texas, Venezuela, and other Caribbean ports by water. Dual-purpose canal in background brings in circulating water and oil barges



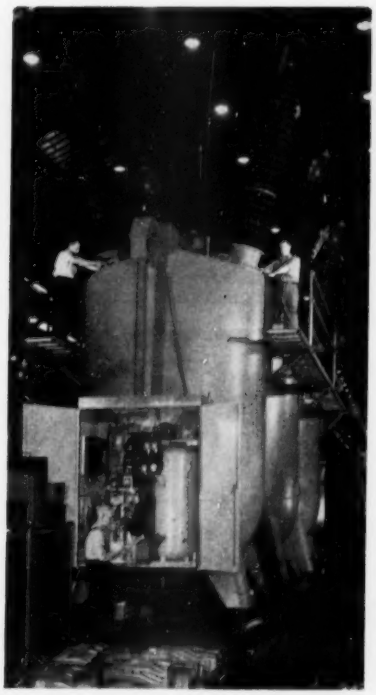
Aerial view of the Cutler Plant shows the excavation and foundation forms for one of the new units. Switchyard is at the upper right and the circulating water inlet is at lower left

Caterpillar's new York, Pa., plant boasts this heating plant which runs eight months on public utility gas, four months on propane stored in tanks in foreground

Commonwealth Edison's new Will County station unloads its first bargeload of coal to start building its reserve of 400,000 tons before going into operation next year with 300,000 kw; ultimate capacity is million kw



A-C's 92-ton low-pressure spindle for a 125,000-kw cross-compound turbine sports record 40-inch long exhaust blades. Special rig speeds its assembly



Pittsburgh-sized circuit breaker! This 330-kv circuit breaker has an interrupting capacity of 25,000,000 kva and will serve the high-voltage system being installed for the giant atomic energy plant near Portsmouth, Ohio. Westinghouse, who made this unit, will eventually supply 34 more for the Ohio system. Over-all height is 28 ft; oil capacity will be about 10,000 gal per assembly

Power Plant GRASP-

Are You Engineer or Watchman?

You know men with plenty of technical knowledge but do they have understanding? Using a simple steam-engine example, the author shows how some commonly-accepted practices in the power plant don't stand the test of plain common sense. He indicates a method of picking things apart that will lead you to question many long-standing dogmas and to get a real grasp of engineering operations—mark of the good engineer

By **FRANK H. BROWNING***

OPERATING ENGINEERS are a peculiar sort of men. Few realize just how peculiar they are. And, unfortunately, there are not nearly enough of that peculiar kind to fill requirements.

We cannot apply the title of Engineer to those operators who are mere attendants, faithfully, blindly, doing as they were told without understanding how things work, and hoping nothing serious will happen.

Competence as a real operating engineer depends on clear grasp and judgment, and these come chiefly from that special ability to "see" the invisible forces, actions and results and so avoid the troubles others dread. Instead of following routine or even figuring out formulas, the real engineer senses the trend of natural laws. He has learned the process of questioning, analyzing and reasoning through to a clear grasp. He deserves all our respect.

GRASP is the biggest word in our language. It seems that training to that end has been sadly neglected, left to chance, in the usual courses and texts. So, if you power plant men will give this your active support, we will try to explain and illustrate the process of picking things to pieces until they finally look so simple one feels like kicking himself for not seeing it before.

How Do You Set Valve Gear?

Let's investigate a common sample. When setting an engine's valve gear, certain marks are made for finding dead center. There is entirely too much tendency to have the piston very near the end of its stroke as shown by positions 2 and 3 in Fig. 1. With the crank at position 2, a scratch mark is made on the crosshead and guide at position 1; and a mark 4 is made on the flywheel, using a rigid tram heeled on some fixed point. Next the engine is turned past dead center, watching the marks closely as the crosshead moves a little farther out, then back toward the crank end until the marks at position 1 again line up exactly.

Then make another mark on the flywheel with the same tram, divide the distance between the two flywheel marks and again turn the engine until the tram is on this midway mark on the flywheel. This will be the head-end dead center, provided the alignment of slipper guide and crosshead marks at position 1 is accurate and no other mistakes have been made.

Part of the trouble with having the crank so close to the end of the stroke comes from having very little travel of the crosshead as the crank moves the much larger distance from position 2 to position 3 in Fig. 1. Therefore the second alignment of crosshead marks is not likely to be accurate enough to avoid errors on the flywheel marks. It is very much better to use crank positions shown as 5 and 6 on the diagram, where the crosshead is beginning to get some real speed of travel as the engine turns, a couple of inches of *piston* travel, not crank travel, from dead center on a 20 or 24-in. stroke.

Which Direction?

When making these marks, they tell us the engine should be turned in the *same* direction it is to run. There is no telling how many hundreds or thousands of times we have heard it that way. Never once have we heard anyone say it should be turned in the opposite direction. The purpose, of course, is to make proper allowance for any slack at the crosshead and crank pins.

Let's pay closer attention to this ancient, respected, universal dogma passed on down generation after generation. Just for the purpose of seeing the picture plainly, we will consider an engine in bad shape, with $\frac{1}{16}$-in. slack on the pins at each end of the connecting rod, as shown in Fig. 2. That would make a full $\frac{1}{8}$-in. total slack.

With an 8-foot flywheel on a 24-in. stroke engine, that much slack would give a $\frac{1}{2}$-in. error at the rim of the flywheel when the engine is at mid stroke shown in Fig. 2. And with the crank 30 deg from dead center, the crank pin is only 6 in. from the center line and the large amount of slack we have assumed for the sake of this investigation would result in a full inch in marking the flywheel. Having the crank still closer to the end of the stroke will result in more error. With

About the Author

FRANK H. BROWNING has just retired after 30 years' outstanding service as Engineer Examiner for the City of Seattle, Washington. He has had many years of practical engineering work as a leading designer of naval machinery, work in scientific management, and as mechanical engineer for a large industrial company having several big power plants. He has been a member of ASME since 1914, is now a life member. He is also an honorary member of NAPE, Seattle 6.

He found, on becoming Engineer Examiner, that the men he examined for licenses were following numerous parrot-like instructions and customs, with very scanty understanding of how power equipment really works. He soon developed the method, used for 30 years, of getting his examinees to pick things apart, use their common sense and figure out why certain things they had parroted weren't right, and finally figure out for themselves just what the right answer is.

This method, extremely effective, he has used in his famous little book Steam Plant Errors, which thousands of power engineers have bought and used to their great profit. If you want a copy of it, we'll gladly tell you how to get it. His present article is the first of several in which he will show by specific power plant examples how you and your associates can dig into things to get at basic principles and not be smatterers.

After you have read this and the following articles, let us know what you think of them. Argue with the author if you wish. All this may eventually result in a book on Power Plant Grasp.

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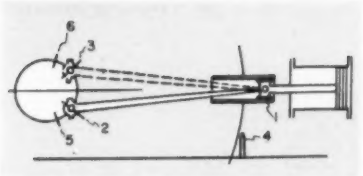

Fig. 1. Diagram of steam engine showing method of marking flywheel and crank positions when setting valve gear

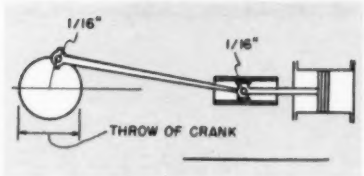

Fig. 2. Diagram of engine showing slack of 1/16 in. at the points indicated would produce error in flywheel marks

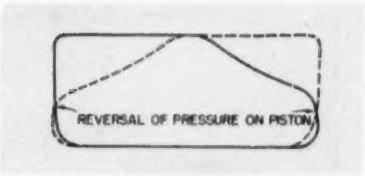

Fig. 3. Steam engine indicator diagram showing points where cylinder pressure reverses on piston as explained in text

the crank pin 1 in. or 2 in. from center line through piston rod and main shaft, the given slack could make a 3 in. to 6 in. error on flywheel marks. Any slack is magnified as the crank approaches center line — another good reason for making flywheel marks farther out.

What's Pushed or Pulled?

Now, let's see what happens. When in operation, steam pressure on the head end crowds all parts together so all places with slack are closed tight. But, when turning the flywheel on the cold engine in the same direction for finding dead center, the crank pulls the piston. Then all the slack is wide open. We will call it *closed* when the parts are pushed together, and *open* when the parts are pulled apart.

It should be clear that turning the flywheel in the same direction the engine will run gives exactly the opposite of the desired result, when the engine is some distance from the end of its stroke. Isn't it strange that the old "authorities" have taken such pains to be dead wrong?

On the back stroke, from crank to head end, turning the flywheel will keep all slack points closed, though when steam is driving it, pressure in the crank end will pull them wide open.

Simple, isn't it? With some practice every man on the job can learn how to pay closer attention so as to size up these things. Then it's a lot more satisfaction to understand how things work, and the power plant will be kept in better condition.

This rotation for dead center may not make much difference on a decently adjusted engine, yet this case is one of the best examples of the benefit gained from the habit of questioning and studying each step, and finding whether there is any real sense in the old instructions.

Cylinder Pressure Reverses

When placing the engine back on dead center after marking the flywheel, engineers are always careful to turn it back too far, then bring it up to the middle mark by turning the flywheel in the same direction the engine runs. Notice that cylinder pressure reverses just before it reaches dead center, as shown in Fig. 3. Compression is then building up in front of the piston, the valve admits boiler pressure slightly before dead center, while exhaust from the other end relieves the opposing pressure.

At the head end center, steam pressure will push all parts together, just the same as when the engine is rolled over by turning the flywheel on the cold engine. Refer to Figs. 1 and 2. So, it makes absolutely no difference which way the engine is turned to its dead center mark. At the crank end, steam pressure will pull all slack wide open for the back stroke, the same as when turning the engine to this dead center from either direction.

It's more than amusing when we find such common mistakes rooted in the power operating trade. To summarize, if slack can make any real difference when marking an engine to find dead center, we get the same relative positions found in the engine during service by always turning the flywheel in the *opposite* direction.

Are Popular Concepts Right?

When some things turn out to be so wrong it is time to investigate many other practices to find out whether they can stand the test of plain sense.

Solomon advised "Above all get understanding." The New Testament tells us "Prove all things, hold fast to that which is good." When closer investigation shows former ideas are correct, one gains much better grasp of power plant control. If they turn out wrong, one acquires more interest and confidence in the process of reasoning, paying close attention to each small step until the results are reliable.

The findings of this writer come from 30 years' experience probing the minds of applicants in many lines, from helpers and journeymen to foremen and superintendents in various mechanical and electrical activities, from firemen to chief engineers, from sub-professional assistants to principal engineers on design and construction projects. In the course of such investigations he has discovered and upset faulty notions of old "authorities." Those thousands of contacts and appraisals have led him to firm beliefs at variance with popular concepts.

Our first important conclusion is that all such groups are human — with human limitations. Though we pay full homage to the truly great men of remarkable achievements, there are no superhuman minds. Prominent men with high degrees are just as apt to make mistakes as the rest of us, when they have no clear grasp of things they remember; when they speak without full consideration of all the facts; when they venture beyond the field of their recognized competence and especially when they become infected with the virus of importance of infallibility.

Memory and Thinking

Our second discovery is that the members of every group can be divided into two main classes. The vast majority rely on memory, sometimes gathering a prodigious quantity of old relics, like a museum. They repeat what they heard, like a phonograph record.

Relatively few belong in the other class — those who have learned to analyze and reason, and so acquire understanding in place of indiscriminate repetition of second-hand opinions. We place good operating engineers in this latter group.

We find most men in power plants have good natural ability — intelligence. Yet many feel they are handicapped by the lack of higher formal schooling. Somehow we must cure that mistake, for our contacts prove it is entirely unwarranted. We never did believe the boilers and engines would care how a fellow spells EKZOST, if he uses his head. We would say they have just as good heads as those in other groups, some brilliant, some few beyond hope, mostly very good material. They feel at fault when study has left them confused, baffled, groping for something tangible and useful. They should realize, instead, that the real fault lies with certain teachers and with half-truths in condensed texts. When students do not learn, the instructors and texts have failed to teach.

Now to you Chief Engineers: If you are not the gruff, hard-boiled type that went out of style last century, show these to your assistants to start them thinking. Ask them other questions to think about. If they cannot come up with good, clear answers, better ask them more leading questions on the same subject instead of giving them the answers without using their own heads. Prod them on the simple common things they handle every day. With friendly encouragement, never satisfied until explanations would be clear enough to an inquisitive beginner, you will be amazed at the enthusiasm for more and more.

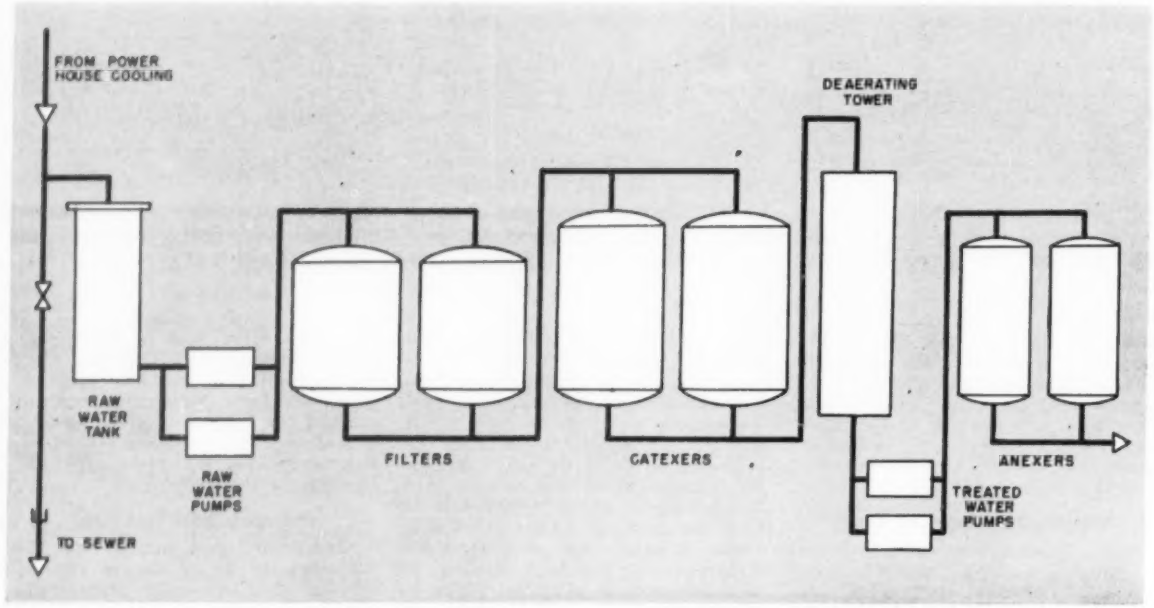

Fig. 1. Schematic diagram of the two-bed demineralization system chosen for installation in the Hawthorne power plant

Demineralization Cuts Power Costs at Hawthorne Plant

A two-bed demineralizer was installed at Western Electric's Hawthorne Works; here's how it operates automatically, how the control valve trouble was cured, how the system now performs, and what it costs

By C. E. MORROW *
and F. C. GEHLE †

Demineralization	Purchase Price	$/1000 gal. D.M. Water	Internal Treatment (Normal Weekday)	
Water wasted to sewer	$0.12/1000 gal.	$0.023	Tri-Sodium Phosphate 68 lb at $0.022/lb	$1.50
Sulfuric Acid 66° Be	20.00/ton	0.033	Sodium Sulphite 6 lb at $0.042/lb	0.25
Sodium Hydroxide (50%)	3.79/100 lb	0.035	Sodium Hydroxide 3 gal at $0.051/gal	0.15
Loss of Exchange Material				
Sulfonated Coal	12.00/cu ft	0.002		
Nalcite SAR	75.00/cu ft	0.010		
Total		$0.103	Total	$1.90

Table I. Operating cost breakdown for demineralization and internal treatments

WATER TREATMENT equipment, installed during the recent rehabilitation of the plant that is sole source of power for Hawthorne Works, Western Electric Co., in Chicago, cost about as much as 3 years' fixed charges on a standby steam generator and high-pressure turbine. It was money well spent, however, for it prevented production losses due to unscheduled outages without the installation of such standby equipment. Either production losses or increased fixed charges would have offset a portion of the operating savings resulting from 900-psi topping operation.

Plant rehabilitation consisted of replacing 16 stoker-fired, 175-psi, 500-F boilers with three coal, oil or gas-fired steam generating units capable of generating 150,000 lb. per hr at 900 psi (835 F) and superposing two 6250-kva noncondensing turbine generators over the 175-psi system. An isolated boiler plant was replaced by pipe line transmission. This plant rehabilitation was described in POWER ENGINEERING, May, 1953, page 86.

During peak winter conditions it was estimated steam demands would reach 450,000 lb per hr with both high-pressure turbines operating to provide optimum steam utilization. Length of such demands would be determined by outside temperatures of less than 20 F and were, therefore, of indeterminate duration and might occur any time between the first of November and the first of March. Experience of others with the type of equipment involved indicated its dependability to be of a high order, if boiler feedwater quality was suitably high.

Normal operation would necessitate 15 to 20 per cent makeup, depending on heating load. Contamination of industrial returns or condenser leakage would increase this demand considerably. With all industrial returns wasted and one 7500-kw condenser leaking, makeup of 500 gpm would be necessary. High-bicarbonate Lake Michigan water with about 128 ppm total hardness was available for this purpose.

It was necessary to install new treatment equipment in the space occupied by an acid sodium zeolite unit of 190 gpm capacity. Study of space and dollar economy led to the installation of a duplex, two-bed ion-exchange demineralizer, each half capable of producing 200 gpm continuously. This was backed up by about 200,000 gal of existing treated water storage at a head sufficient to

* Power and Service Facilities Engineer, and
† Mechanical Engineer, Hawthorne Works, Western Electric Co., Chicago.

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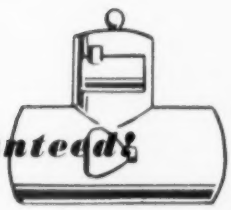

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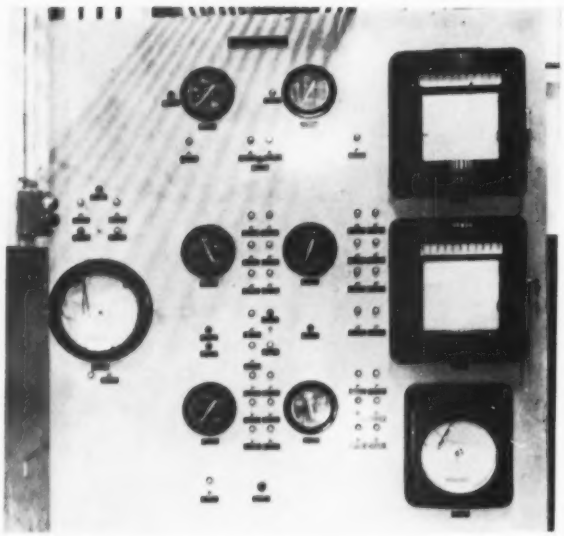


Fig. 2. Control panel for automatic demineralization system

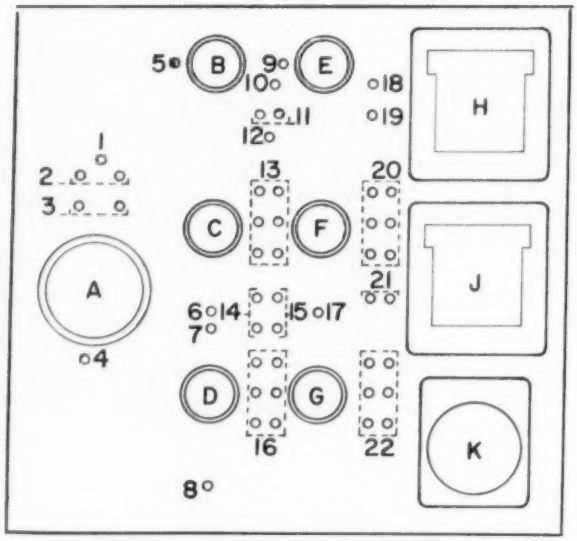


Fig. 3. Schematic of control panel (legend in table below)

provide gravity flow to the deaerator.

The two-bed process is so well known it is unnecessary to discuss its operation in detail. Water from anthrafilt bed filters goes to a cation exchanger where sulfonated coal exchanges hydrogen ions for cations; i.e., salts become acids. The effluent is then passed over a degassing tower where CO_2 resulting from carbonates is removed. The remaining anions are then removed by a highly-basic exchange resin. The cation unit is regenerated, after 216,000 gal production, with 1 per cent H_2SO_4 and the anion exchanger, after about twice this output, with 4 per cent NaOH. Before regeneration the cation unit is back-washed with filtered water and the anion exchanger with cation effluent. The product since the unit was placed in service has been better than guaranteed performance of 0.2 ppm silica, 0.2 ppm hardness and 5.0 ppm dissolved solids.

Legend for Fig. 3. Letters designate instruments; even numbers designate alarm lights; odd numbers designate operational indicator lights. Listing is by groups

INSTRUMENTS

A. Raw Water Temperature Recorder.
B. Acid Dilution Water Flow Indicator.
C. N Catexer Flow Indicator.
D. S Catexer Flow Indicator.
E. Dilute Caustic Flow Indicator.
F. N Anexer Flow Indicator.
G. S Anexer Flow Indicator.
H. Effluent Water pH Recorder.
J. Anexer Effluent Conductivity Recorder.
K. Effluent Flow Controller & Recorder.

ALARM LIGHTS

2. High & Low Level Surge Tank.
4. High Temperature Raw Water.
8. Air Low Pressure Alarm.
10. High Temperature Dilute Caustic Tank.
11. High & Low Level Dilute Caustic Tank.
13. N Catexer Backwash, Brine, & Rinse; High & Low Pressures.
14. High & Low Level, Degasser Tank.
16. S Catexer Backwash, Brine, & Rinse; High & Low Pressures.
18. High & Low pH.
19. High & Low Level Caustic Storage Tank.
20. N Anexer Backwash, Brine & Rinse; High & Low Pressures.
21. High Conductivity N & S Anexer Effluent.
22. S Anexer Backwash, Brine, & Rinse; High & Low Pressures.

OPERATIONAL INDICATOR LIGHTS

1. High Temperature Cooling Water Bypass.
3. Raw Water Pumps.
5. Acid Proportioning Pump.
6. Catexer Regeneration.
7. Degasser Blower.
9. Caustic Proportioning Pump.
12. Dilute Caustic Pump.
15. Treated Water Pumps.
17. Anexer Regeneration.

Automatic Two-Bed Units

Previous to this installation, the only two-bed units in operation were of low capacity and full automatic operation had not been attempted. It was desired that all back-washing, fast and slow rinses and regeneration, together with mixing of regenerant solutions, be carried on without attendance. It was possible to accomplish this fully automatic operation to the extent that it is only necessary to supervise the filling of the concentrated H_2SO_4 and 50 per cent NaOH storage tanks.

Responsibility for power plant operation is centered in a control room on the turbine floor in an adjacent building about 125 ft from the water treatment area. In order that this point of constant attendance may be aware of the functioning of the demineralizing equipment, an alarm alerts the control-room operator in case any phase of the system does not function properly. In addition, the top portion of the boiler master panel shows levels in treated water storage tank and deaerating heater. An alarm sounds in case of high or low level, and lights an indicating drop showing the source of the alarm.

It would not be practical to show all demineralizer alarm points on indicating drops in the control room. In case of trouble an alarm sounds in the treatment area and the control room. In the latter location an alarm drop lights, spelling out "F.W. Demineralizing System Alarm." When such an alarm is registered, an attendant goes to the treatment room where he can see at once the cause of the trouble by referring to the control panel shown in Fig. 2. Functions of the different indicators and alarms are shown on a schematic of this panel in Fig. 3. The legend (above) identifies panel components.

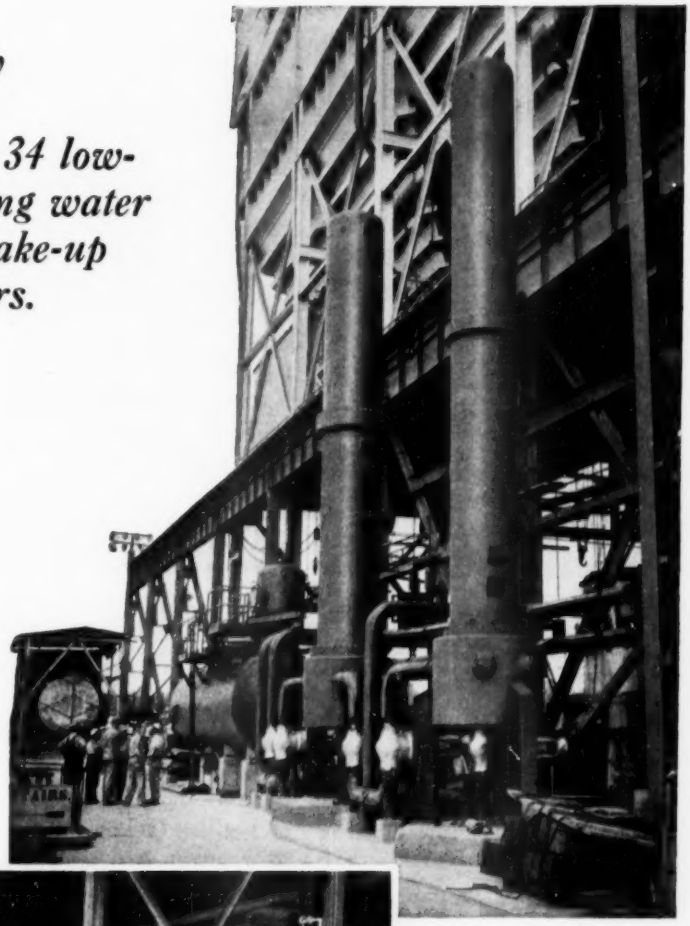
Chemically the system functioned perfectly from first operation, but the usual difficulties incidental to new development were encountered. We will discuss in detail these difficulties and their solution for the benefit of others exploring like fields. Also we wish to point out how other parts of the process gave no difficulty.

Control Valve Trouble and Care

Most significant of the problems was the early excessive maintenance of the air-operated 4 in. diaphragm control valves used to direct and control the flow of water and regenerant. These are now constructed as shown in Fig. 4 and there are 22 in the system. *Continued on page 91*

68 units to serve
JOPPA STEAM-ELECTRIC STATION

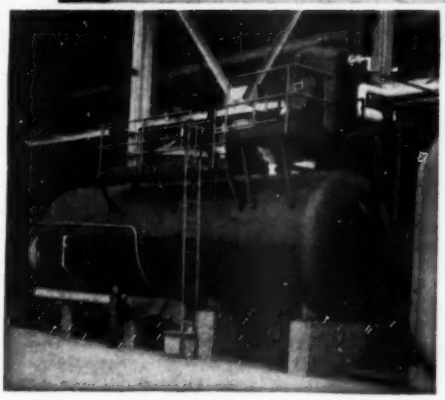
Feedwater installation by Foster Wheeler includes 12 high-pressure heaters, 34 low-pressure heaters, 18 cooling water exchangers (including make-up heaters) and 4 evaporators.



Constructed by Electric Energy, Inc. to supply approximately half of the power for AEC's Paducah Area Project, the Joppa Steam-Electric Station is designed for 937,500 KW in six boiler and turbine units. Of the semi-outdoor type, it represents one of the largest electric power stations ever planned for one building operation.

Few installations require the number of heaters which this new station will have when completed; probably none can boast of larger high-pressure heaters. The six crossover high-pressure heaters each have a surface of 7,760 sq ft capable of heating 1,162,700 lb of feedwater per hr from 411.1 F to 470.4 when supplied with steam at a pressure of 497 psia, total temperature of 721.1 F. The six 10th-stage high-pressure heaters each have 4,858 sq ft surface. Each set is equipped with desuperheating, condensing and drain-cooling sections, and is built for handling 3200 psi, 500 F water.

The closure for these high-pressure heaters incorporates the well-known "Lockhead" feature. A patented Foster Wheeler construction, this closure provides a means for supporting the head pressure load that is separate from that for supporting the gasket compression load. Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.



▲ Crossover and 10th-stage feedwater heaters. Crossover heater is approximately 38' high. Shell design pressure is 550 psi at 800 F; tube design pressure 3200 psi at 500 F.

◀ Foster Wheeler evaporator with deaerating preheater. Total heating surface 3450 sq ft capable of evaporating 30,000 lbs net vapor per hr.

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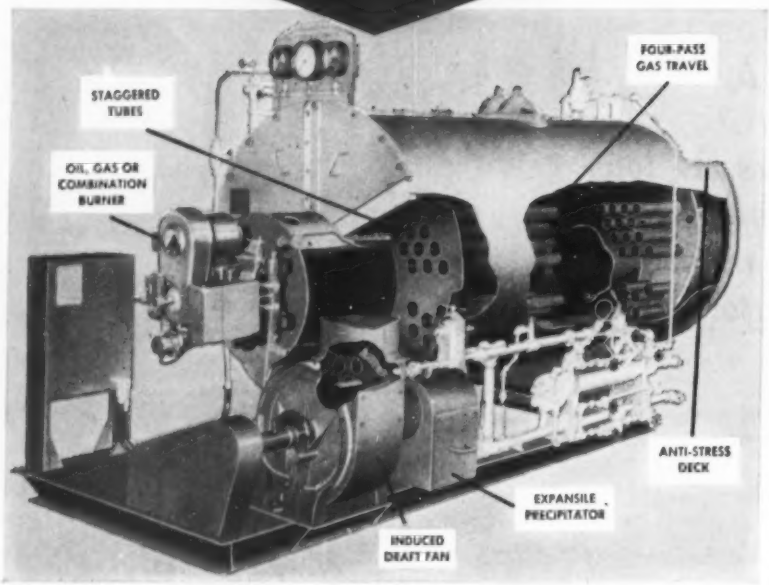

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American Cancer Society

DEMINERALIZATION . . . . .

continued from page 88

Until this application, they had been operated with air pressures of less than 75 psi. Under these conditions their operation was satisfactory. Because of the storage tank floating on the system, it was necessary to operate with 115-psi air.

The diaphragms were originally rubber and the seats molded with plastic. Repeated failure of both diaphragms and seats in 18 valves installed in a horizontal position led to correction of the difficulty. The guide (shown cross hatched in Fig. 4) was not used originally, and the forcing diaphragm did not have sufficient rigidity to keep the free end of the cast-aluminum spacer from canting downward. When the valve closed, the force exerted by the operating air was concentrated on a small area of the water diaphragm and seat. Repeated closings on these areas caused the water diaphragm and seat to fail. Uneven deformation of the forcing diaphragm caused it to crease and rupture after short service.

Guiding the spacer improved the condition but introduced another problem. Its addition made it necessary to cut out the center of the forcing diaphragm and keeper. This exposed a small area of the spacer top to air pressure. The small compressor furnishing operating air began to run continuously without keeping up pressure. The spacers were found to be sufficiently porous to permit passage of air to the space between diaphragms where it escaped through a bleed port. Impregnating spacers with resinous material stopped this leakage. Seat and diaphragm maintenance were improved by guiding spacers, but continued to be excessive until stainless steel seats were installed and diaphragms strengthened by nylon inserts.

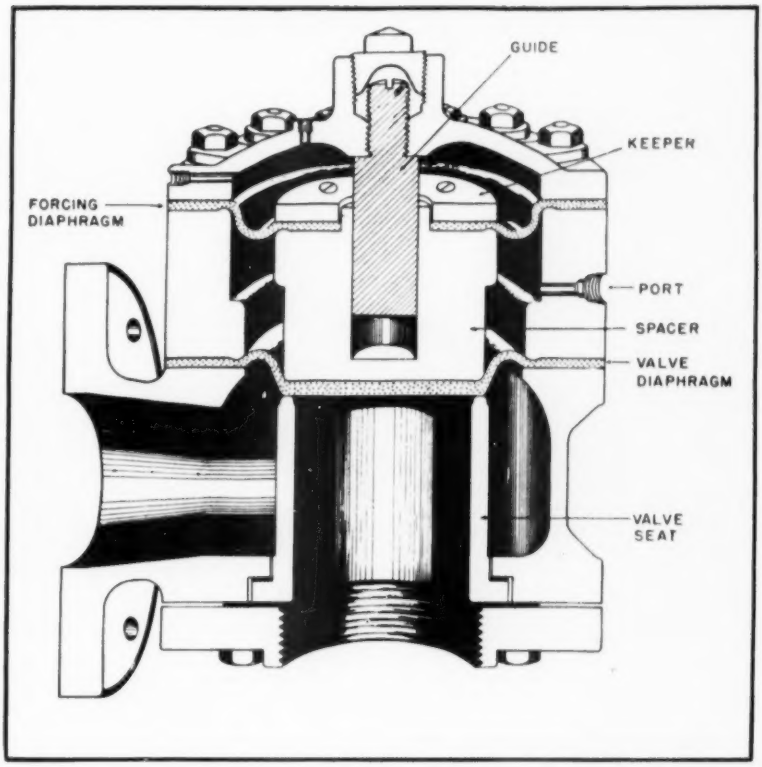


Fig. 4. Cutaway of hydraulic diaphragm valve after addition of plunger guide

Acid Handling

Completely unattended regeneration would not be possible without automatic proportioning of water and concentrated H_2SO_4 for regeneration of the cation exchanger. This is accomplished by a proportioning pump mixing the strong acid with water flowing to the unit being regenerated. The flow of H_2SO_4 is controlled by varying the pump stroke and water flow by a PRV and plug cock used as an adjustable orifice.

Concentrated H_2SO_4 will not corrode steel pipe, but the original design recognized the possibility of the difference in specific gravities of strong acid and water causing sufficient dilution between regenerations to cause trouble, and Carpenter 20 pipe and fittings were specified for the acid line. This material was not available during construction, so steel pipe and fittings were used. The pipe did not last one week.

In an attempt to improve conditions, a lead trap was installed in the acid line next to the cross where water and acid mixing occur, with an air operated valve on the acid side of the trap. This valve was controlled by air supplied through a solenoid valve in the circuit supplying the proportioning pump motor. This arrangement held strong acid back of valve unless the pump was runing and confined dilution to the lead trap sufficiently to greatly increase the life of the acid line. Now that Carpenter 20 is available, it has been installed.

Anion exchange unit regeneration is greatly affected by temperature and it is impractical to mix this caustic solution in the same manner the cation regenerant is mixed. A 50 per cent NaOH solution is purchased and stored in a 1200-gal. tank. A proportioning pump operating through a timer adds a definite volume of the strong caustic to a mixing tank over a predetermined interval. At the same time, demineralized water is added to the mixing tank with the rate of flow controlled to permit the correct amount of caustic to be furnished before the tank is full. Water is shut off when high level contact is made. A thermostatically-controlled steam coil maintains the 3 to 4 per cent caustic solution in the mixing tank at 98 F. This process has operated successfully since it was placed in service.

Normally, water supplied to the demineralizer is city water that has been used for cooling in air compressor inter- and after-coolers, and other heat exchangers about the power plant. Sufficient heat exchange returns were not available during the past winter and the deficit was made up directly from the city mains, resulting in an exchange bed temperature of from 50 to 60 F. Operation at these temperatures resulted in conductivity of the product increasing from 0.5 to about 5 micromho and silica content from 0.02 to 0.15 ppm. Addition of city water direct from mains was discontinued sufficiently in advance of regeneration to bring bed temperatures back to normal, and the product quality returned to that expected.

Tri-sodium phosphate, sodium sulphite, and sodium hydroxide are fed internally to remove residual hardness and oxygen, and to control pH. These chemicals are fed by four variable-stroke proportioning pumps with two pistons each, so arranged that any piston can pump any solution to any boiler. This equipment has functioned satisfactoriiy since it was placed in operation.

Getting Samples

Samples of both steam and boiler water were originally collected in a cylinder 4 in. in diameter and 2 ft long. Steam or boiler water was introduced through the bottom, and cooled by a ½-in. coil circulating cold water located at the top. The steam

or flash from the boiler water was condensed in this way and falls to the bottom. The sampling line extends 4 in. above the bottom and retains this amount of water in the cylinder. This is sufficient to submerge a cell and permit checking conductivity at constant temperature.

Three sampling cylinders were installed on each boiler, making it possible to check, at any time, conductivity of steam before and after superheater, and of the boiler water. A single indicator on each boiler starting panel shows the conductivity selected by a transfer switch. If the conductivity selected goes out of limits, an alarm sounds and is indicated by a lighted drop in the central control room. The selector switch is normally set to indicate conductivity of steam leaving the superheaters.

This arrangement was successful in securing steam samples where silica and pH were the only determinations desired. They were not effective in securing water samples where it was necessary to determine sulphite content. Samples taken for laboratory determinations showed a wide variation in sulphite because, when they were taken from the overflow on the original sampler, the temperature was high enough to greatly increase speed of oxidation in presence of air. Boiler water samples are now taken from a coil contained in a cylinder where cooling water flows continuously. With this arrangement, it is no longer possible to check boiler water conductivity on the boiler panel indicator.

Determination of silica content of the boiler water has been difficult. There seems to be no reasonable relation between silica in the boiler feed and that in blowdown. It was originally thought it would be necessary to maintain not more than 8 ppm in the boiler in order to avoid silica in the steam; determinations showing 15 ppm have resulted in clean steam.

When the first boiler was put in service, it was expected the silica would be high because of construction dirt that had not been removed by blowing and washing. This was true, but when there was no decrease over a reasonable period, the blowdown was increased, but silica also increased. Blowdown was decreased and silica decreased until blowdown reached about 1½ per cent. A study is being made at present to determine the optimum condition existing between boiler silica, blowdown and clean steam.

Performance of Demineralizer

Since the demineralizing equipment has been in operation, it has produced water better than guaranteed. Exchange rates of beds are well above the guarantee, and the loss of exchange materials is less than expected. Except during the period described when low temperature operation reduced quality to almost that guaranteed, day-to-day operation produces water with 0.02 ppm silica, 0.2 ppm hardness, a pH of 8.5 and conductivity of 3 micromhos. Chemical cost of both internal and external treatment is shown in the table. Once, during regeneration of an anion exchanger, a small amount of caustic reached the boilers because of control valve failure. No harm was done, for it was discovered almost immediately and blowdown was increased to correct the pH.

Steam generator No. 3 went on the line with the first high-pressure turbine on December 5, 1951. Since that time it has operated 16,400 hr, or about 81 per cent of the time. It has been opened twice for insurance inspection and there was no evidence that cleaning was necessary. Unit No. 4 and the second high-pressure turbine were put in service on March 5, 1952. It has since operated 15,000 hr, or about 83 per cent of possible use. Last summer it appeared to be dirtier than Unit No. 3, and was acid cleaned.

Analysis of the spent acid indicated about 685 lb of calcium scale to have been present. No explanation of why this unit picked up more scale than Unit No. 3 is evident from perusal of feedwater and boiler water data. Unit No. 2, last on the line, was placed in service December 8, 1952, and has operated about 7835 hr, or 76 per cent of the time. The above percentages do not indicate availability because, for 5 months of the non-heating season, there are many periods when the operation of two units is sufficient.

At present, turbine inspections are scheduled every third year. There is nothing to indicate that the boiler feed pumps cannot be run for much longer periods without opening.

The difficulties with automatic operation appear to be solved, due to the cooperation between the operating personnel and the principal supplier, and the advice of Professor F. G. Straub, who acted in a consulting capacity for Western Electric Co. In view of present operation, solving these problems seems to have been worthwhile. It is apparent there is some silica hide-out in the boiler, but steam purity is excellent. It is also evident that the temperature of exchange beds should be kept as near 98 F as possible for optimum results.

SUPPLIERS OF EQUIPMENT

Demineralizing System	—Infilco Inc.
All Centrifugal Pumps	—Ingersoll Rand Co.
Air Compressor	—Ingersoll Rand Co.
Proportioning Pumps	—Milton Roy Co.
Flow Indicators, Recorders & Controllers	—The Foxboro Co.
Temperature Recorder	—The Foxboro Co.
Conductivity Indicator, Recorder & Controller	—Leeds & Northrup Co.
Panel Fabrication	—Panellit Inc.

Fastest Relay

WORLD'S FASTEST transmission line protective relay equipment was recently installed on a 132 kv line of the Appalachian Electric Power Company in Virginia.

With this new GE equipment the maximum response time to any fault condition occurring on the protected line is one cycle of system frequency (0.0167 sec on a 60 cycle system). Circuit breaker tripping at both ends of the line is initiated within this time after the fault has occurred.

This new equipment enables larger quantities of power to be transmitted, since the high speed operation of the equipment reduces fault clearing time, increases a system's stability, and allows larger amounts of power to be transmitted over lines than was previously possible.

Composed entirely of electronic circuits, the inherent handicap of mechanical inertia of electromagnetic relays is eliminated in the new equipment. Also, because of the types of circuits employed, the speed of response to faults is essentially independent of the magnitude or location of the fault as contrasted with the much slower response of electromagnetic relays to low magnitude faults at distant points on the protected line.

A number of new electronic components were used in the equipment where an improvement in reliability or performance was possible. Germanium rectifiers and tantalum capacitors are used to reduce space as much as possible. Accurate operation over a broad range of control voltage and ambient temperature, in circuits that would otherwise be adversely affected, is obtained by the use of non-linear resistors and thermistors.

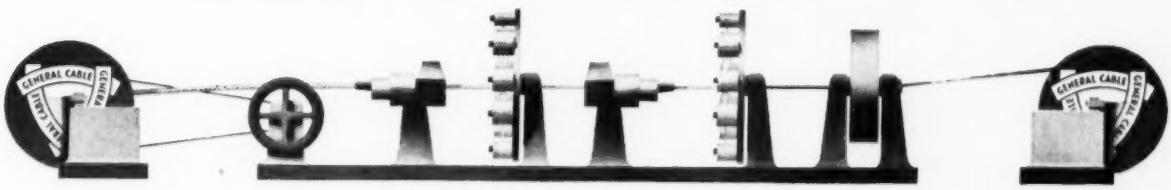
World's fastest transmission line relay

Illustration above shows this new equipment undergoing tests. Plans are for this relay equipment to be used by the Ohio Power Company's new 330 kv transmission system.

THE GREATEST NAME IN ELECTRICAL WIRE AND CABLE

BEAT THE HEAT

on electrical wires and cables at lower cost



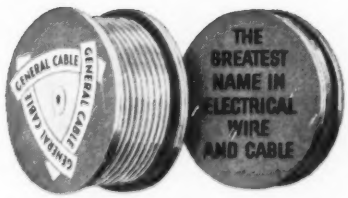
With All-Asbestos and Asbestos-VC

General Cable All-Asbestos and Asbestos-Varnished Cambric wires and cables provide safe, sure wiring for power, control, apparatus leads and switchboard installations. Especially where heat is a factor or when resistance to flame, oil, grease or corrosive fumes is a must.

Better than other types of insulation, All-Asbestos and Asbestos-Varnished Cambric wires and cables permit higher current carrying capacities with the same conductor sizes or the same current carrying capacities with smaller conductor sizes. These wire and cable products are ideal for installation near furnaces, ovens, boilers and in similar hot locations.

STANDARD CONSTRUCTIONS

	Insulation	Covering	Conductor
ALL-ASBESTOS	Asbestos	Asbestos braid, or without covering	Solid, stranded, flexible copper or aluminum
ASBESTOS-VC	Asbestos and Varnished Cambric Asbestos and Gencaseal (polyvinyl plastic)	Asbestos Braid Cotton Braid Lead Sheath	Solid, stranded, flexible copper or aluminum



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For more data circle 545 on Post Card

PRACTICAL ENGINEER and ELECTRICIAN SECTION

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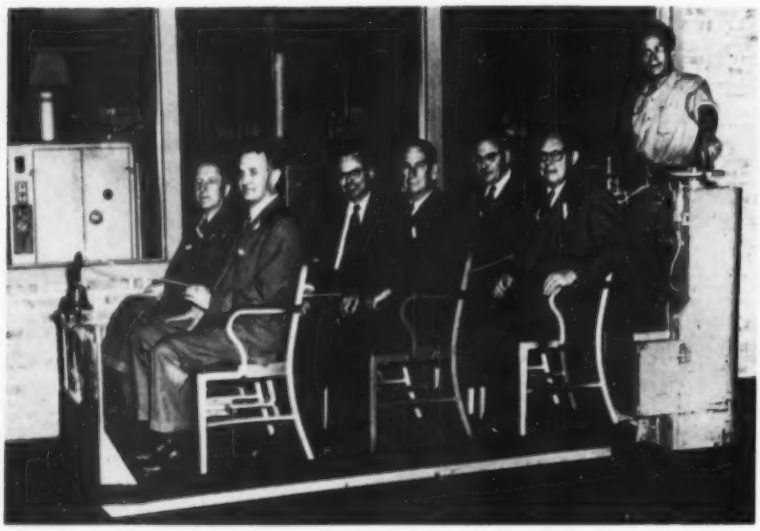
Electric Fork Truck Transports Visitors



Fork truck "Special" stops in front of the power room at Vapor Heating's new plant. Passengers (l. to r.) are N. English (V. P.) and G. Coull (Secty) of Vapor Car Heating, Canada, Ltd.; W. C. Keeran (V. P. Engrg.), A. D. Bruce (Pres.), C. J. Roubik (Director), and D. DeFrees (Director) of Vapor Heating. The bell is also brass

VAPOR HEATING Corporation's new plant near Chicago has drawn so many visitors that some provisions had to be made to transport them around the production areas in safety. Naturally, no large expenditures were regarded with much favor, and most vehicles designed for such purposes could not negotiate the sharp turns in the network of aisles.

Vapor's director of public relations, Don Heaton, came up with an answer that impressed us with its simplicity and adaptability. He mounted six chairs on each of twelve pallets, commandeered twelve electric fork trucks (on a temporary basis), and assembled a unique fleet of "donkey engines" like the one shown in the photograph.

The editors of POWER ENGINEERING toured Vapor's new plant on some of these recently and found the going very comfortable. When closer inspection of some item was desired, it was easy to step off and have a look. Chairs were firmly mounted with short steel straps (see photo) which clamped onto the chairs' crosspieces at their upper ends and were bolted to the pallets at the bottom.

One of the advantages of moving visitors in this manner is that production was uninterrupted, though it was closely inspected.

Hints for Better Control Panel Operation

By L. W. FITZPATRICK

HERE ARE a few pointers to smooth out the operation of control panels in your plant.

Shock resistance and longer life for control panel lights is now possible through the use of miniature aviation-type lamps. These are becoming available in most of the regular styles and sizes used in power plant panels.

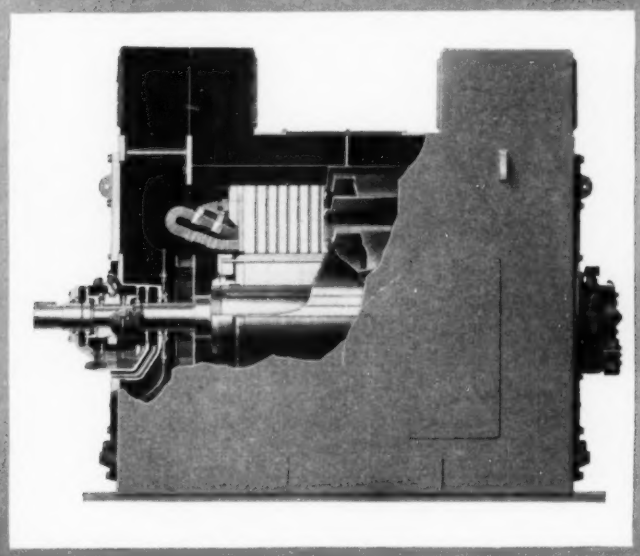
Hot atmospheres surrounding some panel boards lead to shortened component life. Kitchen-type exhaust fans provide economical air circulation through such boards and electronic assemblies where heat has become a problem. Addition of new low-noise types to units which operate continuously may be desirable.

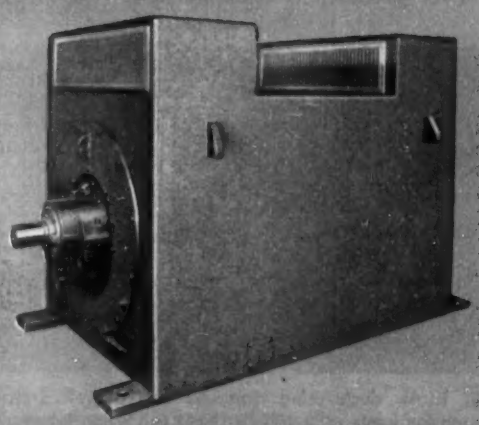
Draftsman's instrument ink remover is a handy aid in cleaning flow-meter and other control instrument pens. It softens ink deposits rapidly and leaves surfaces ready for new ink. Addition of a few grains of phosphate to inks will assure free flow at all times.

"—and this is an air-washer. Get back to work, Mrs. McGinty!"

Redesigned

INSIDE AND OUT





ALLIS-CHALMERS
Boiler-Feed Pump
MOTORS

New features improve 2-pole motors long known for reliability and low maintenance.

New ventilating arrangement features top air intake and discharge *plus* spiral stator core ventilation. Top intakes (available with filters) keep motor clean and make motor room cleaning easy; top discharge adds to personnel comfort. Spiral ventilation — used in turbine generators — assures even internal cooling . . . combines with centrifugal fans and baffled air passages to reduce noise.

Improved bearing design simplifies maintenance, prevents oil leakage. Capsule-type housings — proved in use on other designs — permit inspection of windings without exposing bearings. Oil leakage is prevented by a combination of features, including orifice-metered oil flow, weirs to maintain correct oil level, labyrinth seals, breathers, and annular pressure chambers with atmospheric relief.

Clean-cut appearance is gained by providing internal space for stator and auxiliary leads, etc.

Features that helped build the Allis-Chalmers 2-pole motor reputation for reliability are retained in the new design. These include proven stator coil design, ample stator coil end bracing, thermally and mechanically stable cage assembly, separate balancing rings, and oxygen-free dew-drop cage bars.

This design available in ratings 900 hp and larger. Ask your A-C representative for Bulletin 05R8123. Allis-Chalmers, Milwaukee 1, Wisconsin. A 4350

ALLIS-CHALMERS

For more data circle 546 on Post Card

Combined Damper-Expansion Joint Cuts Duct Insulation Costs

EXPANSION JOINTS and flanges of dampers which interrupt the regular, unbroken surfaces of heated air ducts require special application methods in what is usually a routine insulating job. A frequently practical but overlooked method of reducing both installation time and cost of materials in duct insulation is to locate the joints and dampers side-by-side and cover both together as a unit rather than separately. In the drawing, adjacent V-type expansion joints and damper flanges in circular air ducts at a Massachusetts generating station of the New England Electric System have been neatly and effectively covered in this manner with a single sheet-metal enclosure and banded mineral wool block insulation.

Fig. 1. Air ducts using dampers and expansion joints insulated as single unit

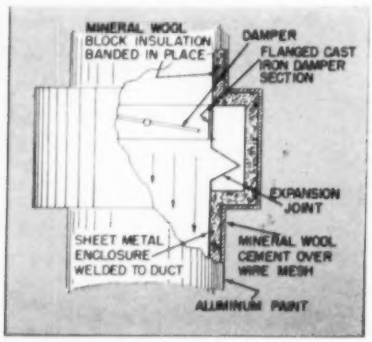

MINERAL WOOL BLOCK INSULATION BANDED IN PLACE
DAMPER
FLANGED CAST IRON DAMPER SECTION
EXPANSION JOINT
SHEET METAL ENCLOSURE WELDED TO DUCT
MINERAL WOOL CEMENT OVER WIRE MESH
ALUMINUM PAINT

Fig. 2. Details of combined-units insulation job showing elements of assembly

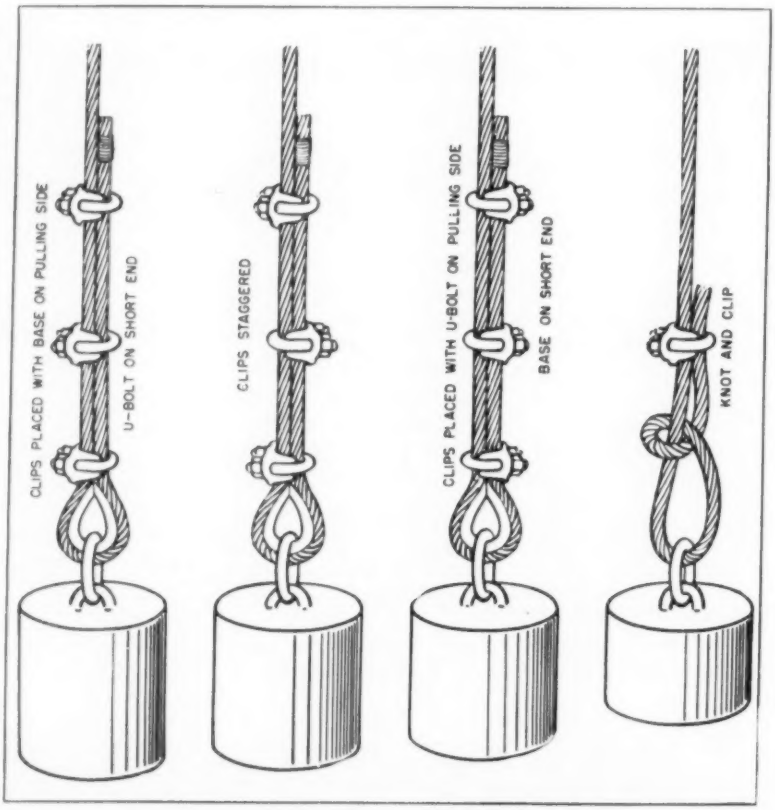
In the photo, the damper and expansion joint are located on three vertical ducts at the intersections where they receive preheated air at about 620 F and deliver it down through fans to the pulverizers. The regular surfaces of both the vertical and overhead ducts are insulated with one layer of 3-in.-thick mineral wool blocks in 12x36-in. sections. The insulating blocks were secured to the ducts with ¾-in. bands on about 9-in. centers, covered with wire mesh, and finished with a ¼-in. layer of insulating cement and a coat of finishing cement.

The standard 12x36-in. block sections were easily cut to fit the three sides of the sheet metal enclosure over the damper and expansion joint. While the mineral wool blocks were also secured with bands on the vertical enclosure surface, the smaller insulation sections on the sides of the enclosure are held in place by the wire mesh. The enclosure insulation is finished in the same manner as the regular duct surfaces. In the photo, the insulating blocks have been cut around the damper control lever on the left of the duct and the cement finish has been smoothly beveled down.

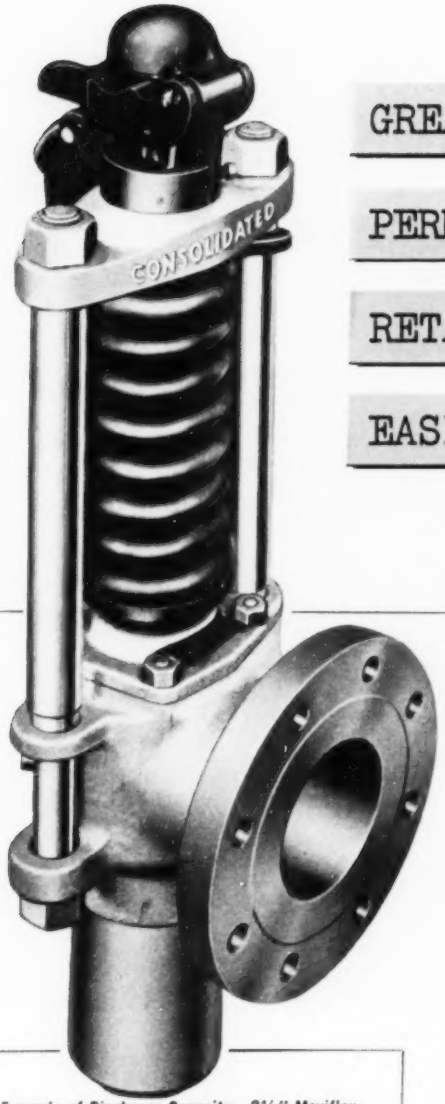
Here Is That "One Best Way" to Clip Wire Rope

THERE IS ONLY ONE correct way to make loops in wire rope with U-bolt clips, and that is by placing the clip base on the rope end which takes the load. A surprisingly consistent set of results are predictable when forming the loop in the proper or any of a number of improper ways (see illustration). When all clips are placed with the base on the pulling side, about 80 per cent of the rope strength can be realized in the loop. When the clips are staggered (next to left) this drops to about 75 per cent of the rope strength. Placing all the clip bases against the short end decreases the allowable load still further to 70 per cent of the rope strength, and a single clip and a knot cuts the rope's load bearing capacity to half.

Had any good ideas lately? Jot them down and send them in. Do not make elaborate drawings, but make them understandable. You will be paid for all ideas published in these pages.


CLIPS PLACED WITH BASE ON PULLING SIDE
U-BOLT ON SHORT END
CLIPS STAGGERED
CLIPS PLACED WITH U-BOLT ON PULLING SIDE
BASE ON SHORT END
KNOT AND CLIP

Correct way to clip wire rope (left) for 80% of rope strength; others are wrong



GREATER DISCHARGE CAPACITY...

PERMANENT TIGHTNESS...

RETAINED POPPING POINT...

EASILY CONTROLLED BLOWDOWN...

CONSOLIDATED *Maxiflow* SAFETY VALVE

sets a new standard in safety and service

Today's high-pressure, high-temperature steam generating plants require safety valves with greater discharge capacity. The Consolidated *Maxiflow* Safety Valve always has it available when needed.

Dependable tightness—month after month—is likewise inherent in the design of Maxiflow. Thermodisc seating equalizes temperature differentials when the valve reseats after blowing—thermal stresses are minimized, distortion is prevented.

Popping point retention is achieved by use of a special alloy steel to stabilize the spring support in the yoke rods—by use of a stainless steel spindle that provides thermal compensation for any elongation of other parts that affect spring loading.

Blowdown control, while the valve is under pressure, requires only a simple external adjustment.

Constant entrance conditions for steam flow are assured by precision-machined forged steel through bushing and inlet. No porous castings to leak.

These are but a few of the performance-proved features that make the Consolidated Maxiflow Safety Valve outstanding in safety and service. Five sizes—1½", 2", 2½", 3", and 4"—make selection easy. Bulletin 707 contains full details, including capacity tables. Write for a copy.

Example of Discharge Capacity—2½" Maxiflow

Gauge Pressure PSI	Capacity Saturated Steam Pounds Per Hour A.S.M.E. Rating
1200	143,700
1500	179,000
2000	238,400
2500	297,600

CONSOLIDATED SAFETY VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONN.

MAKERS OF 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' AND 'AMERICAN-MICROSEN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'HANCOCK' VALVES, AIRCRAFT PRODUCTS. BUILDERS OF "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

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Novel Insulated Grounding System

MOST USUAL METHOD of grounding steel structures is to connect the building columns, via bare copper wire, to bare copper electrodes buried nearby in the ground. While this makes a good ground for electrical equipment, the copper electrode and the steel column may act as a galvanic cell if they are both in contact with earth. The result is accelerated corrosion of the steel column.

At United States Steel's giant Fairless Works in Pennsylvania, a novel grounding system, as described in *The Neoprene Notebook*, has been adopted to avoid this corrosion of building steel. Instead of burying bare copper conductors, they have taken special precautions to prevent a contact between copper and earth.

All ground wire at the Fairless Works is neoprene-covered, which provides sufficient insulation to prevent the copper from setting up a galvanic cell with any buried steel. In addition, building columns rest on concrete piers above the surface of the ground, and while damp concrete will also act as an electrolyte, the danger of galvanic action is greatly reduced.

Specially designed steel grounding beds replace the usual copper. The beds consist of 40-ft steel rods driven into the ground 10 ft apart, with 10 to 80 rods in a bed. The rods are arranged on a square grid, with magnesium anodes buried at the center of the square. The magnesium anodes are to give cathodic protection for the steel rods, which would otherwise rust away. Whenever a connection is made to a steel rod or a magnesium anode, the joint is carefully wrapped with neoprene tape to prevent exposure of the copper to earth.

Insulated wire to steel grounding rods

QUESTIONS AND ANSWERS

Answer to No. 519

How Can He Prevent Corrosion In This Stack?

Watch Temperatures, Accumulations — Fitzpatrick

WHERE logs are floated to the sawmill over salt water bays, they pick up salt and mud, which raise the ash content of the hogged fuel. Average waste wood fuel ash ranges from 0.2 to 2.2 per cent. Slag can form from hogged fuel that has been soaked in salt water.

Steel stack maintenance involves scraping and painting at frequent intervals with high temperature paints; watching temperatures closely and the quality of gases, coupled with atmospheric conditions.

High stack temperatures are commonplace with hogged fuel since none of the standard fuels have as high an oxygen content. Natural gas requires 15.9 lb of oxygen per lb of fuel for combustion. Oil uses 14.0 lb; coal, 11.0 lb, and wood but 6.0 lb.

It is easy to reach high furnace temperatures in burning wood, since it is possible to produce 20 per cent CO_2 with no excess air at a temperature of about 4100 F. It is therefore necessary to use considerable excess air to limit exit gas temperatures.

Improved efficiency and lower fly ash will accompany the lowering of heat release rates below 25,000 btu per hr per cu ft of furnace volume with hogged fuel. Minimum furnace refractory temperatures are particularly important when burning woods containing salts and marine growths since these substances attack refractory walls.

Keep stack bottoms clean from soot and fly-ash accumulations which produce thermal stresses and corrosion through flash secondary combustion fires. Introducing high moisture content hogged fuel gases in an unprotected stack hastens corrosion.

A lined steel stack is the most efficient chimney. Corrosion attacks steel and internal ash corrosion is always a problem. Steel stacks lined 2 in. thick with gunned mortar over suitable mesh and welded holding studs, provide complete protection. The mortar should be an alumnite cement and haydite aggregate. Carefully applied and bonded to the steel, this type lining will remain intact and keep gas leakage between the lining and steel at a low value.

A stack lining automatically protects the outer stack from gas corrosion and erosion. Linings hold exit gas temperatures constant permitting gases to rise higher to atmosphere for better dispersion. Strains are minimized during cold weather from the hot gas exit.

All chimney entrances should be protected from moisture during prolonged shutdowns by a covering, otherwise acids invariably form inside from the accumulated moisture.

L. W. FITZPATRICK
Jefferson City, Mo.

Design Noise Out Of Air Ducts

Here is a comprehensive answer to Question No. 520, "How to Avoid Undue Noise in Air Ducts?", which appeared in the February issue. This article considers the nature of noise in ducts, and how to correct noisy designs

By H. B. WAYNE

SOUND is caused by air particles set in motion by a vibrating source. From this source, the sound travels in waves which are spherical in shape and which travel at a constant radial velocity. Such waves are usually simple harmonic or sinusoidal, and in air they exist as alternate condensations and rarefactions moving away from the vibrating source. Sound pitch is determined by the frequency of vibration of the source, while intensity and sound level is determined by the amplitude or displacement of the wave. Since noise is undesirable sound, the principles described above apply to noise.

Question No. 520 does not state the type of service, air flow, pressure, or temperature, nor does it describe the fan type (centrifugal or axial flow). These variables influence the acceptable velocity and resultant noise level. Sounds generated by fans result from the fan blades intercepting air, which builds up pressure on one side of the blades and rarefaction on the other. These pressures are proportional to the pressure developed by the fan since they are caused by the same means; a change affecting one, therefore, affects the other.

If "EP" lubrication poses a problem for you . . . here's help!

Here's new technical letter on Stanogear Compounds—send for free copy today!

If you've been having lubricating problems with overloaded or shock-loaded gears on your equipment, New STANOGEAR Compounds—with 7 better EP lubricating features—are made just for you. New and improved STANOGEAR Compounds are recommended for industrial gear applications where the operating conditions of the gear unit demand an extreme pressure lubricant . . . their superiority has been proved in test after test and *on the job!*

New STANOGEAR Compounds work seven ways better to solve your EP problems: **1.** higher load-carrying capacity **2.** superior retention of load-carrying capacity **3.** freedom from objectionable deposits **4.** excellent storage stability **5.** good water separation **6.** anti-foaming **7.** increased versatility

Now Standard Oil has prepared a special technical letter to give the complete story on STANOGEAR Compounds and EP lubrication. For your copy of this factual, informative bulletin, call your nearest Standard Oil office. The Standard Oil lubrication specialist there can answer your questions and send you a copy of the EP story, without obligation. Or write to: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY STANDARD *(Indiana)*

For more data circle 548 on Post Card

Intensity of sound varies as the square of the effective sound pressure in the wave and will vary as the square of the developed fan pressure. For a fan developing a given pressure, the intensity varies as the volume of air entering and leaving the fan. This results because the intensity varies with the flow area, and area and capacity are directly proportional to velocity pressure (head). From this it may be seen that noise intensity varies as capacity times pressure squared, or as the fifth power of the fan speed.

When designing a new system, it is recommended that the fan speed be checked to determine whether or not the conditions described might develop. The National Association of Fan Manufacturers' Code gives permissible sound intensity values.

Table I lists recommended and maximum air velocities for different types of structures and services. Using this data and the equation

$$A = \frac{Q}{V}$$

it is possible to estimate the required duct area for passing the designed air flow. In this equation, A = required area in sq ft, Q = air flow rate in cfm, and V = permissible air velocity in fpm (data from Table I).

The reduction of noise transmitted along a duct varies (a) directly as the duct length, (b) directly as the duct perimeter, (c) inversely to the duct cross-sectional area, and (d) directly with the coefficient of sound absorption of the material of which the inner surface of the duct is made. One method for the reduction of noise calls for the subdivision of the duct into smaller passages to give more material per foot of length. Another scheme enlarges the duct to provide a sound trap, which would have baffles arranged so that only reflected waves can pass through; these baffles would be covered with a sound-absorbing material. The slight pressure drop is limited to the short duct runs only and can usually be tolerated.

Another alternative is to line the duct with sound-absorbing material which converts sound energy directly into heat through losses incurred in the narrow interstices of the fibers and in the inelastic bending of the fibers. The liner may be ½ to 1½-in.-thick hair felt or a similar insulating material, covered with wire netting or perforated metal to minimize air resistance (see Fig. 1). This also prevents loosening of the material and serves as a fire retardant. Insulation ½ in. thick is usually sufficient for all these purposes, but remember that the material will be compressed when the metal liner is applied and allow for this compression when selecting the thickness. For low-noise-level applications, such as offices and conference rooms where the background noise level is particularly low, insulation 1 to 1½ in. thick may be required.

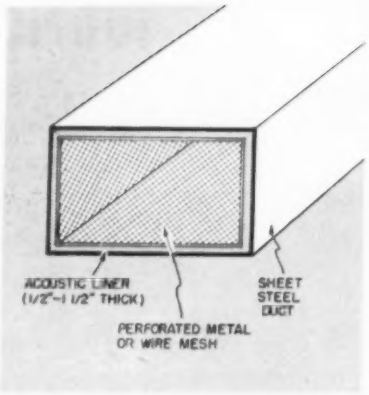


Fig. 1. Application of absorbing liner

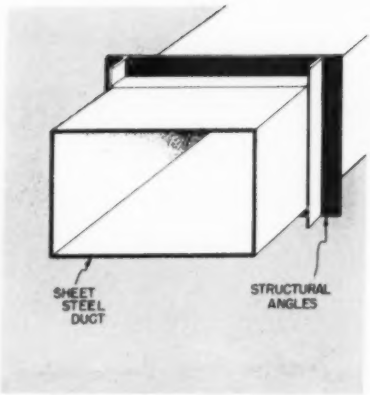


Fig. 2. Application of duct stiffeners

A formula for calculating sound reduction resulting from duct liners is:

$$R = 12.62\left(\frac{PL}{A}\right)a^{1.4} = CL\left(\frac{P}{A}\right)$$

In this equation, R = sound reduction decibels, P = perimeter of duct in inches, L = duct length in ft, A = duct area in sq in., a = sound absorption coefficient of the material, and C = a constant. Values for a and C are given in Table II and are for different frequencies for 1-in.-thick materials commonly used for sound-deadening surfaces. The tabulated frequencies are multiples (harmonics) of the lowest listed value. These data are an indication of expected absorption. If this method is to be used, it is suggested that specific absorption coefficient values be obtained from the manufacturers for different materials.

Since objectional noise may result from a vibrating duct, it would be wise to compare the natural frequency value of the duct structure with the frequency of the air stream. If the stream frequency is a multiple (harmonic) of the fundamental (natural) frequency of the duct, a resonant condition will result. This leads to a high noise level caused by vibratory disturbances.

The natural frequency of a structure such as a duct is expressed:

$$f = \frac{1}{2\pi}\sqrt{\frac{k \times g}{w}}$$

In this equation, f = natural frequency in cycles per second, k = spring constant (force in lb required to deflect the member one in. midway between rigid supports), g = acceleration due to gravity in in. per sec per sec, and w = weight in lb between rigid supports.

From this equation, it can be seen that the natural frequency varies inversely as the square root of the weight of the structure. By adding sufficient mass to the duct, the frequency may be reduced to an acceptable value. This may be obtained by using thicker duct walls (heavier-gage metal) and/or applying structural reinforcement to the duct as shown in Fig. 2.

Table 1. Recommended air velocities for heating and ventilating ducts in buildings

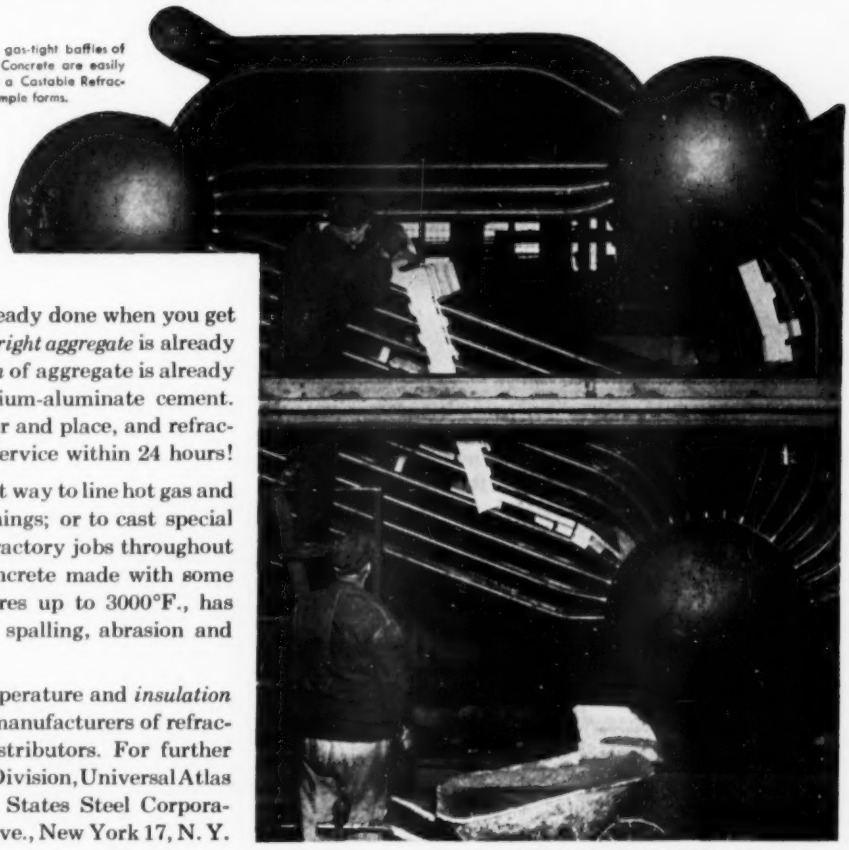
	Recommended Velocities (fpm)			Maximum Velocities (fpm)		
Buildings →	Residence	Public	Industrial	Residence	Public	Industrial
Outside Air Intakes*	700	300–1000	1000	800	1200	1500
Filters*	250	300–400	350–600	300	700	1000
Heating Coils*	450	500–600	600–750	500	600	800–900
Air Washers	500	500	500–700	500	600–700	600–750
Fan Outlets	1000–1600	1300–2000	1600–2400	1700	1500–2200	1700–2800
Main Ducts	700–900	1000–1300	1200–2000	800–1000	1100–1400	1300–2400
Branch Ducts	600	600–900	800–1200	700	800–1000	1200–1600
Branch Risers	500	600–700	800	650	800–900	1200

* Velocities are for total face area, not the net free area.

Table II. Values for factors a and C for 1-in. materials at different frequencies

Frequency in Cycles per Second	128	256	512	1024	2048	4096
Absorption Coefficient "a"	0.151	0.346	0.652	0.795	0.734	0.677
Constant "C"	0.90	2.60	6.90	9.20	8.20	7.30

CASTABLES give you a *head start* on your next Refractory job



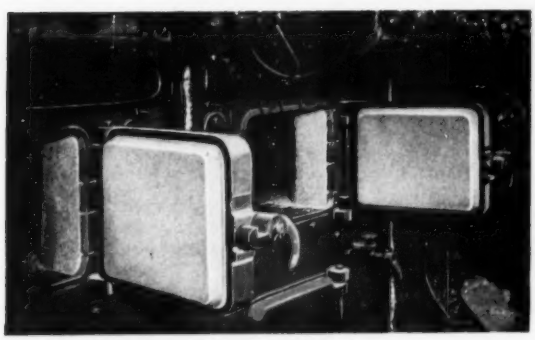
Monolithic, gas-tight baffles of Refractory Concrete are easily made with a Castable Refractory and simple forms.

TWO PARTS OF THE JOB are already done when you get Castable Refractories. The *right aggregate* is already selected. The *right gradation* of aggregate is already mixed with Lumnite* calcium-aluminate cement. All you do is mix with water and place, and refractory concrete is ready for service within 24 hours!

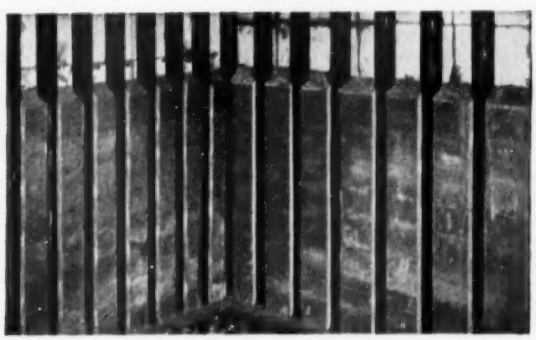
That's the fast, convenient way to line hot gas and air ducts, stacks and breechings; or to cast special shapes . . . and do many refractory jobs throughout your plant. Refractory Concrete made with some Castables takes temperatures up to 3000°F., has low volume change, resists spalling, abrasion and corrosion.

CASTABLES to meet specific temperature and *insulation* requirements are made by manufacturers of refractories and sold by their distributors. For further information, write Lumnite Division, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Ave., New York 17, N. Y.

Packaged Castables used in these jobs were made by Mexico Refractories Company, Mexico, Mo.



DOOR LININGS made with adaptable Castable Refractory Concrete. Unnecessary to stock large inventories of special shapes. Instead, special shapes can be cast in place or poured in molds as needed. Volume change is negligible.



TUBE PROTECTING Water Wall Studding made with a Castable Refractory is tough and highly radiant, uses a different aggregate than baffles (above). With Castables you get Refractory Concrete tailor-made for the job.

**"LUMNITE" is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

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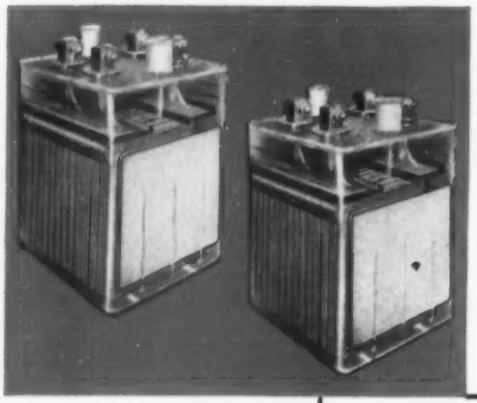

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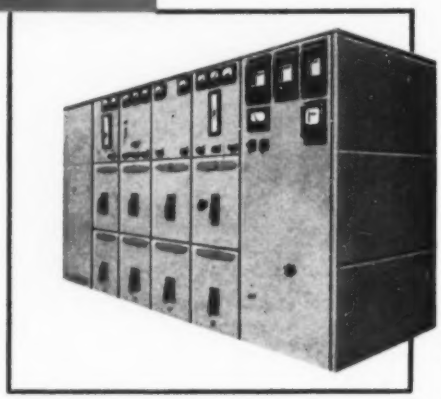

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OBITUARIES

Gustaf A. Gaffert

GUSTAF A. GAFFERT, partner and chief engineer of Sargent & Lundy, consulting engineers of Chicago, died on May 5, 1954. He was 53 years old.

Mr. Gaffert was one of the best-known power engineers in the country. His writings on power engineering problems, especially his text-

book, Steam Power Stations, have exerted wide influence in the art, both in the United States and abroad. The textbook has gone into four editions and has recently been translated into Spanish.

For many years, together with the other members of the firm of Sargent & Lundy, he has worked on the design of some of the country's most important power plants built by the leading utilities, and he was recognized as a leader in this field.

Mr. Gaffert was born in Worcester, Mass. He received a B.S. in M.E. from Worcester Polytechnic Institute in June, 1923. He was awarded the degree of Doctor of Science in Mechanical Engineering by the University of Michigan, in June, 1934. From 1923 to 1925 he taught mechanical engineering at Worcester Polytechnic Institute. From 1925 to 1927 Mr. Gaffert taught mechanical engineering at the University of Illinois.

Mr. Gaffert started with Sargent & Lundy in 1927. From 1936 to 1940 he served in the capacity of mechanical engineer. He was made a partner of the firm in 1940, and chief mechanical engineer in 1948. On January 1, 1954, he was appointed chief engineer.

He was a member of the Executive Committee of the Power Division of the ASME from 1936 to 1940; a member and permanent secretary of the Turbine Standardization Committee of the ASME; and a member of the Western Society of Engineers. He was awarded a fellowship in the ASME in 1951. Mr. Gaffert had been a resident of Winnetka, Ill., for the past 15 years.

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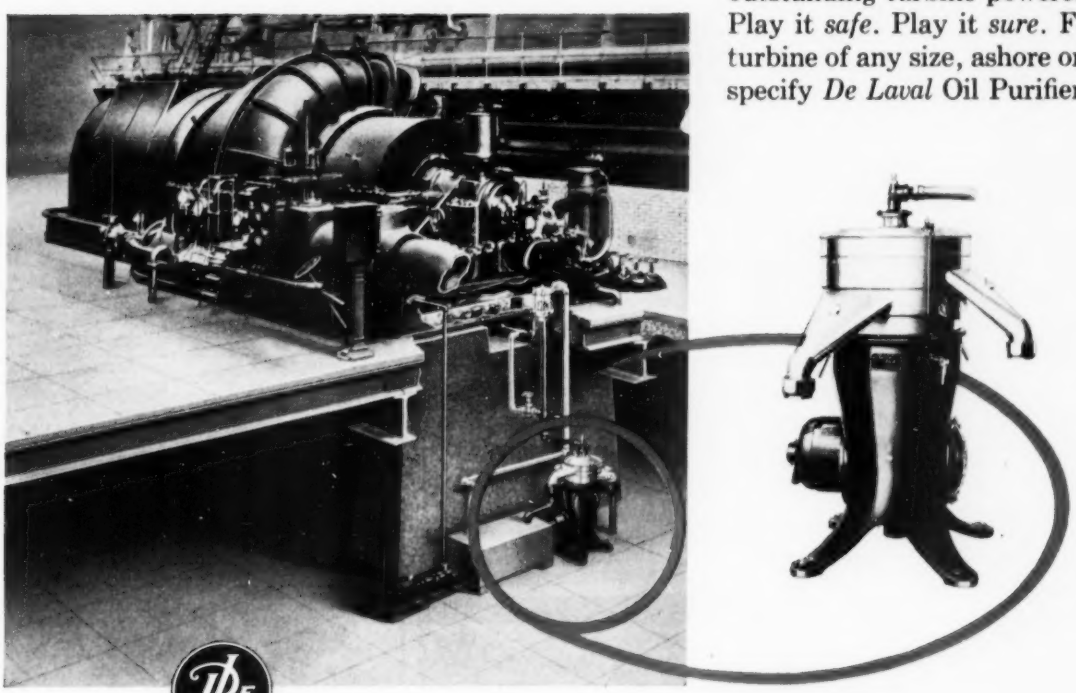

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OBITUARIES

Continued

Charles R. Crane

CHARLES R. CRANE II, vice president and director of Crane Co., died suddenly May 8 at his home in Chicago. He was 61 years old.

A grandson of the founder of Crane Co., Mr. Crane was associated with the company for 46 years. He started as an apprentice molder at the company's Chicago factory in 1908 and worked in various departments until 1912 when he was named superintendent of the garage. Late in 1916 he became assistant general superintendent of all manufacturing departments.

Mr. Crane then became, successively: assistant to the vice president in charge of manufacturing; assistant vice president of sales; vice president of sales, and in January, 1935, he was elected vice president in charge of European operations.

At the time of his death he had supervision over the executive policy of the company's subsidiary in England. He also handled special customer relations assignments.

He was, at various times, director of subsidiary companies and most recently he was director of both the parent company and of Crane Ltd.

During World War I he served as a 2nd Lieutenant in the Ordnance Department.

NEW ENGINEERING BOOKS

Energy in the Future, by Palmer Cosslett Putnam; 1st edition, 556 pages, 6½ x 9¼ ins.; cloth binding. Published by D. Van Nostrand Company, Inc., 250 Fourth Ave., New York, N. Y. 1953. Price $12.75.

This book presents a study of the problem, "Where Can We Find Sources of Low-Cost Energy in an Abundance Equal to the Maximum Plausible Demands by the Expanding and Industrializing Populations of the Future?"

In 1949, the Atomic Energy Commission asked Palmer Putnam to make a study of the maximum plausible world demands for energy over the next 50 to 100 years. This book embodies the results of that study. The author's systematic analysis of the problem includes a review of past population growth in a search for answers to the question, "Is population growth predictable?" Having concluded that it is not, he creates the device of a hypothetical trustee of energy who then asks, "What are the maximum plausible populations of the next 50 to 100 years and what are the maximum plausible demands for low-cost energy?" The maximum plausible world population in the year 2050, says Putnam, will be 6 to 8

billions. Coal, oil, and gas, the low-cost fossil fuels, will have been depleted. It is essential therefore, to accelerate the development of atomic power, explore nuclear reactions other than the fission of uranium and thorium and explore all ways to obtain income energy from sunlight in more useful forms and at lower cost than now appear possible.

The author is a consulting engineer, a graduate of MIT; he carried out post-graduate research in Germany and at Yale. In collaboration with General Electric and the S. Morgan Smith Company, Mr. Putnam designed a 1250-kw wind turbine, the largest yet developed. This was the Grandpa's Knob installation erected in Vermont in 1941.

He is the author of other scientific articles and books and is in consultation with the United States and foreign governments on ways to harness solar energy, wind energy and other substitutes for the diminishing reserve of low-cost fuels.

* * *

American Standard Code for Mechanical Power Transmission Apparatus, ASA B15-1-1953; size 7¾ by 5¼ in.; 47 pages; paper bound. Published by the American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y. Price $1.00.

This code deals with the guarding of all revolving and reciprocating parts of equipment used in the transmission of power. It involves shafting, pulleys, belt, rope and chain drives, gears, chains, and so forth. The information in the booklet can be used to advantage by the producer as well as user of machinery. The purchaser can also use it to help him in drawing purchase specifications.

* * *

Basic Engineering Mechanics and Machine Design, by S. S. Aidlin; 200 pages, mimeographed; illustrated; size 8½ by 11 in., cloth cover, plastic spiral binding. Published by Pelex Publishers, 95 Liberty St., N. Y. 6, N. Y. Price $3.00.

Here is another in a series of books prepared by this author and others. This particular one is based on lecture notes for a review course for the professional engineers licenses examination given by the State of New York.

It begins with an introduction to vectors, then covers elasticity, temperature stresses, force and motion, energy, power and friction. These are followed by chapters on angular speed and acceleration, rotation of a body, gears and gearing; Chapter 9 deals with work and machines; Chapter 10 with projectiles; Chapter 11 with rigid connectors link work; Chapter 12 with buoyancy and flotation.

Each chapter is illustrated with diagrams, and contains specific problems with their numerical solutions. It should prove most valuable not only preparing for licensing examinations but also in reviewing the basic principles for general engineering work.

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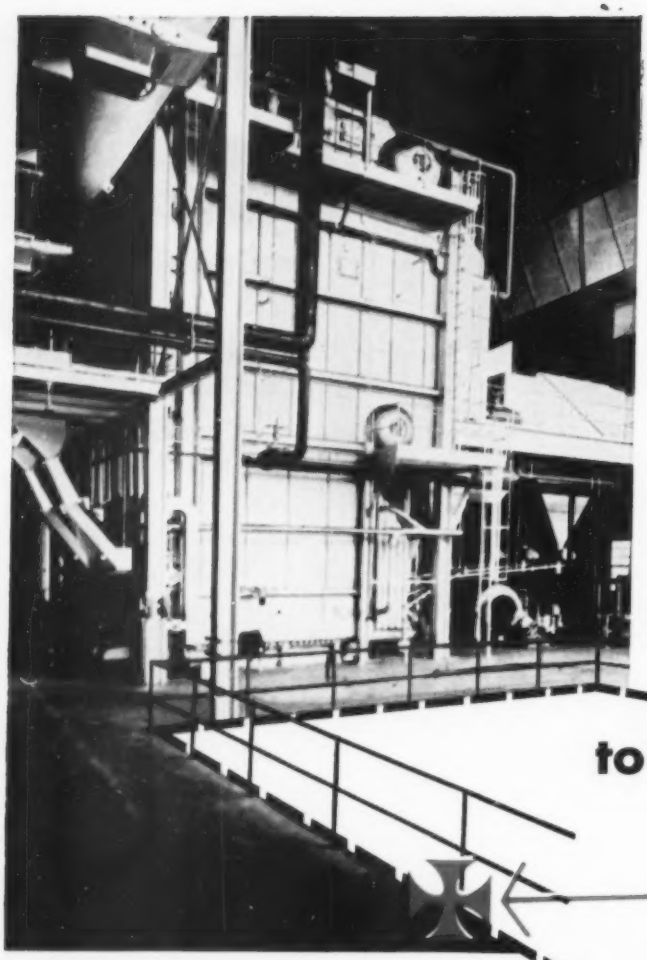

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Standard catalogs listed monthly to help you maintain a reference library

FUEL OILS, LUBRICANTS

201 **Diesels, Their Fuels and Lubricants** — This 46-pp book gives practical information on diesel engines, covering their history and economics as well as design characteristics and operating principles. Classification of diesels according to speed is covered. A chart shows relation of engine performance to fuel properties. Sinclair Refining Co.

202 **Versatile Industrial Oil** — Described in 20-pp Form AD 4078 is an all-purpose oil offering protection for a wide range of industrial equipment, and available in 15 viscosity grades. Discusses six major characteristics of the oil; explains and pictures its use in hydraulic systems, speed reducers, air compressors, electric motors, hydraulic turbines, bearing systems, etc. A chart shows grades available, their uses and physical properties. Standard Oil Co. (Ind.)

203 **Turbine Oil Conditioning** — Bulletin 832-P, 12 pp, offers a detailed explanation of the reasons for turbine oil conditioning, the way in which company's dry type conditioning equipment nullifies or prevents factors which promote deterioration of oil. Bowser, Inc.

204 **Turbine Lubrication** — The special problems of turbine lubrication are discussed in 8-pp Bulletin TU-1. Tells how purifiers keep power units in service; discusses inhibited and uninhibited oils, company's process for reducing sludge formation within lubrication system. Illustrated with diagrams of typical installations. DeLaval Separator Co.

205 **Compressor Lubrication Problems** — Vol. 40, No. 1 of Lubrication provides a 14-pp article on problems associated with compressor lubrication. Reviews compressor types, function of the lubricant and importance of adequate installation. Air compressor explosions and receiver fires are discussed, as are condensation and compressor cooling, bearing lubrication, selection of lubrications. Special problems of air, gas, refrigerator, and other compressors are treated. Includes lists of factors which control dependable compressor operation; those which may react against efficiency. The Texas Co.

It's easy to get these free catalogs—just circle item numbers of those wanted on the post card at right.

206 **Air Compressor Lubrication Manual** — Valuable information on air compressor maintenance is contained in this 40-pp book. Subjects treated include

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compressed air, compressors and related equipment, lubricating systems, compressor oils and applications, lubrication requirements, operating hints, oil requirements, storage and care of compressor oils, also safety precautions. Cities Service Petroleum, Inc.

208 Cooperative Technical Consultation Service — This informative 24-pp booklet presents company's periodic consultation service aimed at the most efficient use of petroleum products. Covers services available in the solution of lubrication problems, metalworking operations, processing, fuel oils, dust control. Gulf Oil Corp., Gulf Refining Co.

INSTRUMENTS AND CONTROLS

209 Supervisory Instruments — Catalog 90-2. "Supervisory Instruments for Power Generation" consists of 41 pp on the instrumentation involved in generating stations. Separate sections cover steam generation instrumentation, turbine and generator instrumentation, electrical distribution instrumentation and diesel engine instrumentation. Measurement of temperature, pressure, flow, power generation are discussed. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

210 Instruments, Controls — Condensed Catalog 1537 offers brief application information on manufacturer's line of instruments. Fully illustrated, covers draft and pressure instruments, flow meters, liquid levels and pressure gages, CO_2 meters, pneumatic transmitters, positioning operators, temperature instruments, boiler feedwater controls, others. Includes references to detailed literature on each type of equipment. Republic Flow Meters Co.

211 Easy Reading Gage — An all-hydrostatic remote reading gage for boiler water and other liquid levels is described in Catalog 500, Section CO. Pictures improved visibility, other advantages offered by this gage, explains operation. The Reliance Gauge Column Co.

212 Steam Calorimeter — This bulletin discusses an improved U-path calorimeter combining a throttling, separating and re-evaporating calorimeter in a single chamber. Explains construction and operation of unit. Ellison Draft Gage Co., Inc.

213 Control Equipment — Catalog 003, 32 pp, presents company's equipment for the control of liquids and gases for water and sewage works, power and process industries. A well illustrated booklet, it lists many types of controllers, gages, manometers, valves, venturi tubes. Description of the units, their operating characteristics, construction details, mountings, specifications and other data included. Simplex Valve & Meter Co.

214 Metering and Control Equipment — Sixteen-pp Bulletin 18 is a comprehensive catalog offering information on company's meters, control equipment and engineering services. It is written for engineers in power plants, public utilities and process plants. Fifteen measured variables common to power and process operations form the index for selecting appropriate metering and control equipment. Basic specifications, and detailed literature references included. Bailey Meter Co.

215 Steam Specialties — Catalog 53, 62 pp, describes a line of steam, gas, air, oil and water regulating equipment. Includes complete specifications, opera-

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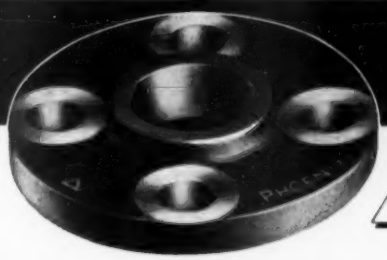

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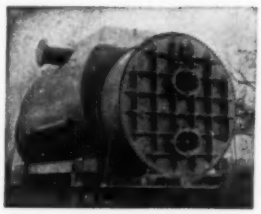

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PHOTOGRAPH BY RICHARD BEATTIE

To every Uncle in the whole wide world...

UNCLES are more wonderful than anybody, and children can never have enough of them.

When Uncles come to visit you, they bring you candy and presents, and they talk to you like you were a grownup yourself, and they let you do things your mother mostly won't let you do.

My favorite uncle is Uncle Ralph. He's sick in the hospital with cancer, and people say that he is going to die because they found out about it too late. They say that only a miracle can save him, and you can't expect miracles.

But my father told me about an Uncle *he* had once (did you know fathers have uncles, too?) And this uncle was supposed to die for sure because he had something called diabetes. But he's alive now, though he's very old and lives in St. Petersburg, because they found something called insulin.

Maybe somewhere scientists will find something that will save my uncle. Dad says they're trying all the time and they're making lots of progress, but they need more money.

Last year, he says, people gave the American Cancer Society enough so they could spend almost $5,000,000 to try to find new cures for cancer. Dad says that is more than ever before, but it is less than four cents a year for each American. That doesn't seem like much, because I get more than that for gumdrops, in just a week, when I'm good.

I thought if all the other uncles knew about this, then they would send more than four cents—lots more. Won't you—? Please.

American Cancer Society

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tional data and prices on pressure regulators, temperature regulators, combination pressure-temperature instruments, diaphragm valves, motor operated valves, float valves, safety and relief valves, strainers, solenoid and motor valves, water gages. Provides capacity tables, flange charts. O. C. Keckley Co.

216 Electronic Feedwater Control — Three systems for the electronic regulation of boiler feedwater are explained briefly and diagrammed in Bulletin 52-1073-221. They include a single-element, two-element, and three-element system. Applications for each type are given, and descriptions of the flow measuring, receiving, level measuring elements, power unit and valve are included. The Hays Corp.

217 Transmitter Unit — Bulletin 9563M describes and illustrates a pneumatic signal transmitter for use with company's ring balance meter. Using a schematic diagram of the operating mechanism, booklet explains how speed, accuracy and stability of the transmitter, in combination with the ring balance meter, provides an instrument adaptable to a wide variety of metering, control uses. Hagan Corp.

218 Ideas on Push-Pull Controls — Included in this "Idea File" are answers to a power engineer's questions on the use of push-pull controls. A general information booklet discusses remote control applications, explains construction and operation of company's Tru-Lay controls. Separate bulletins are devoted to standard assemblies, bracket-type head controls, micro controls and hand-operated controls. Automotive and Aircraft Div., American Chain & Cable Co., Inc.

BURNING EQUIPMENT

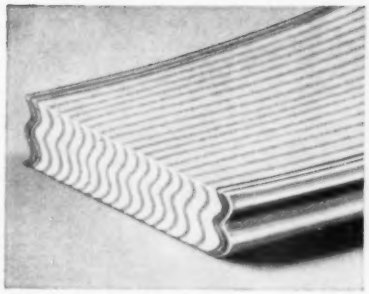
219 Automatic Burner — Bulletin 420 contains approximately 30 pp of engineering data on a new burner unit for gas, oil or combination firing and sized for capacities to 42,000 lb of steam per hour. Separate sections of this looseleaf manual are devoted to photos and discussion of special features of the burner, general specifications, parts list, wiring and piping diagrams, explanation of operating sequence, and performance data. Available to qualified power engineers, please state your job title when requesting this bulletin. Peabody Engineering Corp.

220 Oil and Gas Burners — Bulletin OB-53, 28 pp, gives principles of selection and application of oil or gas burners, or a combination of both for standard and wide capacity range operation, together with air registers and fuel oil heating and pumping sets. Conversion table shows approximate relationships between quantity of oil burned, boiler capacity and air required for combustion. Specifications included. The Engineer Co.

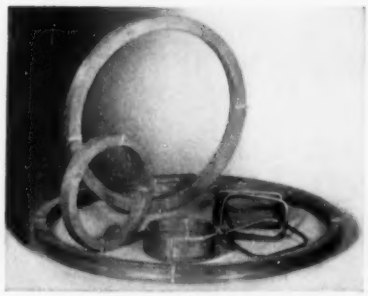
221 Steam Atomizing Oil Burners — Sixteen-pp illustrated Bulletin 21 describes steam atomizing oil burners and auxiliary equipment for use with heavy oil or tar in boilers, stills, dryers and other furnaces, where steam or compressed air is available for atomizing the oil. Includes information on furnace design and construction. National Airoil Burner Co., Inc.

BOILERS, GENERATORS

222 Shop-Assembled Boiler — Sixteen-pp Bulletin G-76 completely describes and illustrates company's Type FM water-tube integral-furnace boiler,



Cross section view of the GUARDIAN gasket shows its unique and rugged construction—alternate layers of metal and asbestos. The inner and outer edges are reinforced with two or more thicknesses of metal. For use against acids and other chemicals, GUARDIAN gaskets are made of stainless steel with "Teflon" filler.



GUARDIAN gaskets are made in round, oval, square, flatside, diamond, and pear shapes. They are furnished in a wide range of sizes for pipe flanges, boilers and other equipment. For raised face pipe flanges, GUARDIAN gaskets with metal centering rings are recommended.

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made in standard sizes from 2000 to 28,000 lb of steam per hr, pressure to 250 psi. Savings in erection, installation and moving costs are stressed. Capacities, dimensions of the boilers are given. The Babcock & Wilcox Co.

223 Packaged Boilers — This 16-pp illustrated catalog describes manufacturer's new Type VP package boiler. Following a section of background information is an outline of the principal design features of these boilers, which are shop assembled and provide steam capacities from 4000 to 30,000 lb per hour. Space requirements are shown in a table along with typical specifications. Also described is control system. Combustion Engineering, Inc.

224 Water-Tube Package Boilers — This bulletin describes and illustrates company's Type H water tube package units. Advantages of the boiler are listed. Also included are dimension drawings and a table of capacities, sizes and weights for ten standard sizes from 8000 to 30,000 lb of steam per hour. The Bigelow Co.

225 Automatic Boilers — This bulletin describes 17 sizes of Powermaster packaged automatic boilers from 15 through 500 hp for steam process, steam and hot water heating service. Lists such advantages as three-pass design, forced draft and automatic controls. Describes firing equipment for light and heavy oils, gas; shows various fuel firing arrangements. Orr & Sembower, Inc.

226 Improved Steam Generator — Bulletin 2000, 28 pp, explains advance design features that distinguish this manufacturer's generator from other unit steam generators. Describes and illustrates engineering differences of component features. Also shows how these components are constructed, assembled and tested. Another section gives data, and dimensions for the units which range from 20 to 6000 hp. Preferred Utilities Mfg. Corp.

227 Steam Generators — Illustrated Bulletin SB43, 20 pp, describes company's VL factory assembled generators combining 2-drum water-tube boiler, integral water cooled furnace, brick work, insulation and steel casing. A large cut-away illustration shows design details, and gas travel. Erie City Iron Works.

COAL, ASH HANDLING

228 Economic Coal Storage — How tractors establish safe, orderly coal handling is told in this 8-pp booklet. Stresses flexibility, low operating costs. Also shows how tractors speed storage reclamation and how a tractor-scraper combination offers plus benefits. Illustrated with action photos; pictures several models. Tractor Div., Allis-Chalmers Mfg. Co.

229 Spreader Stoker — Sixteen-pp Bulletin 800 describes manufacturer's Type C-C RotoStoker, a relatively small spreader stoker offering continuous cleaning and ash discharge advantages of larger units, without need of a basement for ash removal. Explains this and other operational advantages of the stoker, which is adapted to modern steam boilers with output capacities of about 5000 to 75,000 lb of steam per hour. Detroit Stoker Co.

230 Fly Ash Collection — The successful and economical separation of fly ash from boiler flue gases is discussed in 28-pp Catalog G405. Explains need for collection equipment and gives physical

characteristics of fly ash. Describes company's Multiclone equipment as to principle of operation, performance and advantages. Also describes CMP units which combine in a single installation the advantages of the Multiclone cyclonic tube with the Cottrell electrostatic precipitator. Western Precipitation Corp.

231 Automatic Coal Scale — Sixteen-pp Bulletin 0352 describes an automatic coal scale for weighing coal as it is fed to boilers, enabling a power engineer to maintain a constant check on boiler efficiency. Book gives construction and operating details on the belt feeder, weigh hopper, scale housing, operating levers and accessories. Photos and line drawings show scale features. Richardson Scale Co.

Postage-free cards for ordering these catalogs are provided on pages 107–108. When using them, don't forget to include your job title and company name —even if you want your catalogs to be delivered to your home address

232 Ash Handling Systems — This 24-pp booklet offers technical information on hydraulic and pneumatic ash and fly-ash handling systems. Compiled in question and answer form. Discusses elements and advantages of various systems and disposal schemes. Schematic drawings of arrangements under specific conditions are also included. Beaumont Birch Co.

233 Spreader Stoker Selection — Fourteen-pp Form F-520-A10M is intended to help those choosing a spreader stoker to get the most for their investment, and it points out many factors to be considered. American Engineering Co.

234 Spreader Stoker Data — This is a file of three illustrated bulletins on spreader stokers. The first discusses seven reasons for selecting these stokers and describes their design, construction and operation; the second, dumping grates, the third, installations. Riley Stoker Corp.

TUBING AND ACCESSORIES

235 Condenser Tubes — Excellent information on condenser tubes and their service life is given in this 40-pp illustrated booklet. Subjects discussed include corrosion of condenser and heat exchanger tubes, corrosion resistance and control, the selection of tube materials, and the composition and physical properties of company's alloys. Details on proper installation are given. Scovill Mfg. Co.

236 Nickel Pipe and Tubes — Bulletin T-17 is a 27-pp technical bulletin on the fabrication and design of nickel and high nickel alloy pipe and tubing, illustrated throughout by drawings and photos. Presents tables on mechanical and physical properties, ASME code requirements, recommended welding procedures. The International Nickel Co., Inc.

237 Life Extension for Condenser Tubes — This 32-pp extensively illustrated booklet reports on research into the

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causes of corrosion and means of combating them, as well as the choice of condenser tube materials. Points out that Admiralty metal, long a standard for power plant condenser tubes, works satisfactorily in most installations, but other alloys may be necessary in some circumstances. Revere Copper and Brass, Inc.

238 Double-Walled Tubing — Technical Bulletin 1950, 12 pp, presents tubing designed for conditions where single-walled tube can't withstand simultaneous attack from two types of corrosive media. Describes and illustrates construction, illustrating possible metal combinations. Explains tubing's use in ammonia refrigeration, boilers, steam generators. Discusses heat transfer properties, high temperature use. Bridgeport Brass Co.

239 Tube Cleaners — Catalog 76-A provides 48-pp of information on manufacturer's line of tube cleaners. Following equipment selection and operating hints, this practical catalog describes and pictures cutter heads and drill heads, brushes, and motors, giving sizes, application information. Air valves, hose, lubricators are described and pictured, and a wide range of miscellaneous equipment is shown. Thomas C. Wilson, Inc.

240 Rotary Tube Cleaners — Bulletin R-105 presents air and water driven rotary tube cleaners and cleaner accessories. Illustrates several models and heads discussing special features. Roto Div., Elliott Co.

241 Data on Stress Values — Data Card 154 is designed to help power engineers concerned with the operation of tubular equipment at elevated temperatures and pressures. The card is an adaptation of Table P-7 of the new ASME Boiler Code and is complete with notes and formulas for calculating maximum allowable working pressures. Tubular Products Division, The Babcock & Wilcox Co.

ELECTRICAL

242 Motor-Generator Reference Book — Publication 51R7933 is a 50-pp booklet compiled to assist in the selection of motive power to handle most industrial applications. Neither text book nor ordering catalog, this book provides a brief outline of the various types of motors, generators and motor-generator sets, telling their applications and operating requirements. Booklet is generously illustrated and includes performance data, ratings, information on methods of speed control, general characteristics and dimensions. Allis-Chalmers Mfg. Co.

243 Electrical Maintenance Tips — Booklet B-5477, 28 pp, gives a complete outline of preventive electrical maintenance. Discusses general maintenance programs designed to reduce shutdown time and treats in detail the maintenance of power equipment. A suggested schedule of work and cleaning on power equipment is presented in chart form. Essential information on preventive maintenance for turbines, generators, switchboards, motors is given. Westinghouse Electric Corp.

244 Wire, Cable Ordering Guide — Newly-released General Catalog W-52-3, 186 pp, presents more than 500 different types of wires and cables. Contains comprehensive data on construction and operating characteristics for control and signal cables, cables for construction work, telephone wire and cables, and portable cords.

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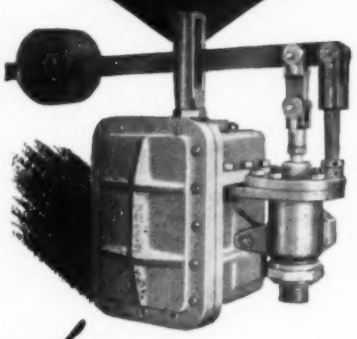

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A technical engineering data section is included. Available to qualified power engineers. United States Rubber Co.

245 Power Distribution Practices — The 28-pp "Industrial Power Distribution Idea Book" (Bulletin GEA 5900) is a guide on electric power distribution practices in large and small plants. Covers utility distribution practices; methods of buying electric power; what to do when a choice of primary voltages is available; application of primary switches and circuit breakers; types and arrangements of primary cables; and types of load-center distribution systems. General Electric Co.

246 Industrial Truck Batteries — Bulletin IT-520 covers company's complete line of industrial truck batteries and gives details such as dimensions, wet and dry weights, types of containers, and capacities at the 6- and 8-hr rate. C&D Batteries, Inc.

247 Motor Lubrication — Three methods of lubricating electric motors — cartridge, standard open and company's Lubriflush — are compared in 8-pp Bulletin 1848. To demonstrate action of relubrication in Lubriflush bearings, a series of natural color photos of a transparent bearing housing is reproduced. Necessity of annual lubrication is demonstrated photographically. U. S. Electrical Motors Inc.

248 Insulation Temperature-Resistance — Technical Publication 21T4, 16 pp, is an article on temperature-resistance characteristics of electrical insulation. Complete with tables and graphs, gives general information on variations in temperature characteristics, composite nature of electrical insulation, and practicability of temperature compensation. Other chapters deal with determining insulation constants for temperature correction factors, dielectric absorption characteristics, and a practical method of obtaining insulation temperature. James G. Biddle Co.

249 The Answers on Wiring — "20 Questions and 20 Answers on Safety m.i. Wiring" describes and illustrates characteristics and advantages of this new wiring system. A complete table of types, sizes, weights and lengths, as well as a partial list of users included. General Cable Corp.

PUMPS, PUMPING

250 Boiler Feed Pump — A barrel-type boiler feed pump for high pressure, high temperature service and designed to go on the line quickly without preliminary warm-up is the subject of 12-pp Bulletin 1525. Fully illustrated text explains automatic operation of hydraulic thrust balance incorporated in this pump. De Laval Steam Turbine Co.

251 Gear Pumps — Besides presenting all of company's standard gear pumps, 24-pp Bulletin 17-A describes briefly some special types engineered for unusual requirements. Discusses design, construction and operation of the pumps; tells how they're used in the power and industrial fields. Drawings, action photos, capacity and pressure tables and performance data supplement the text. Booklet covers pumps ranging from 1 gph to 1000 gpm capacities. Schutte and Koerting Co.

252 Controlled Volume Pumps — Motor-driven controlled volume pumps are fully described in 40-pp Bulletin 553. Provides information on design and construction of the pumps, and includes

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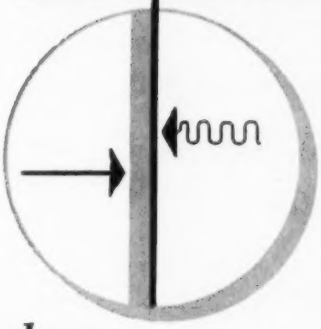

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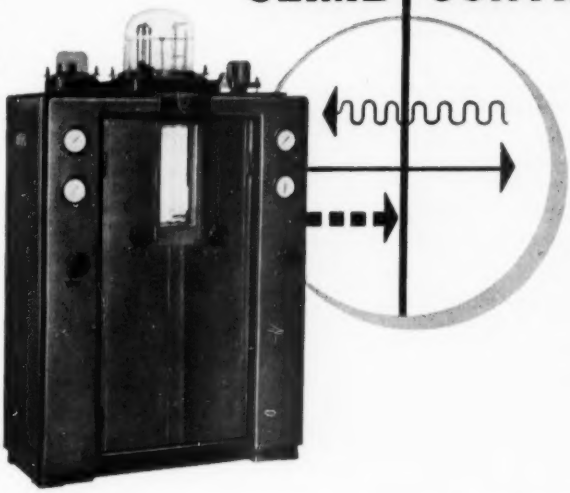

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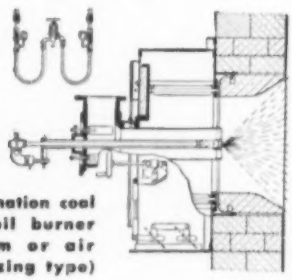
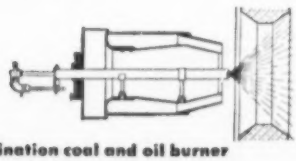


Combination coal and oil burner (Steam or air atomizing type)



Combination coal and oil burner (Mechanical atomizing type)

Enco Burners

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capacity-pressure selection tables, types of capacity adjustments, standard and special designs and packaged systems. A chart shows typical applications in six major industries, and another chart, in full color, shows construction materials suitable for use with some 170 industrial fluids. Milton Roy Co.

253 Boiler Feed Pumps — Bulletin 109, 16 pp, illustrated in color, describes centrifugal pumps for boiler feed service. Pictures construction and major parts, floating seal incorporated. Capacity data included. Pacific Pumps, Inc.

VALVES, TRAPS, PIPING AND ACCESSORIES

254 Check Valves — Twenty-pp Catalog 30 presents company's line of tilting-disc check valves made in iron, bronze and steel for working pressures to 3000 psi. Explains operating principle of tilting disc construction, discusses closing without slam, reduced loss of head, other advantages. Includes construction details, sizes. The Chapman Valve Mfg. Co.

255 Safety Valve Engineering Data — How company's safety valve works and its operating advantages are explained in Bulletin 707. Includes dimensions on valve types, also provides tables on superheat correction factor. Manning, Maxwell & Moore, Inc.

256 Solenoid Operated Valve — Eight-pp Technical Bulletin W-7 describes solenoid operated valves which automatically open or close in response to time clock, pressure switch, manual switch or other impulse. Contains operating instructions, illustrated parts lists, and dimensions for these valves, used in steel, processing, pulp and paper mills, rubber and chemical plants, and water works. Golden-Anderson Valve Specialty Co.

257 General Service Valves — Bulletin E-160, 16 pp, describes and illustrates design and construction of company's quick-operating valves, explaining their application to blow-off service and on chemical process, soot blowers, water column blow-down, and other types of pipe line. Everlasting Valve Co.

258 For Quick Valve Selection — Here's a 20-pp catalog digest providing ordering and application information on gate, globe, angle and check valves in bronze, iron, cast and forged steel construction, also valve accessories and parts. Illustrated and indexed, includes pressure-temperature chart. The Ohio Injector Co.

259 Regulating Valves — Bulletin 5305 describes double seated diaphragm regulating valves for use with control instruments, outlining special features of the valves, particularly the "flow line" contoured body engineered for high capacity at low pressure drop. Leslie Co.

260 Cast Steel Valves — This 56-pp catalog on cast steel valves includes information on globe, angle and check valves in 300, 600, 900 and 1500 lb pressure classes. Parabolic disc valves for hand or motor control of volume are also described. In addition to standard information on construction features, dimensions and weights, the booklet contains complete data on material specifications, prepara-

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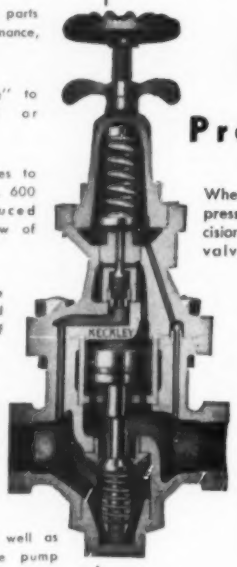

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tion of welding ends, flange facings, and ratings. Edward Valves, Inc.

261 Pump Valves — Sixteen-pp Catalog SC-510, now available to power engineers, describes and illustrates valves made to fit practically all makes of reciprocating pumps. Key features of the valves are discussed, and standard, lock-in and deck types are covered in detail. Sims Pump Valve Co., Inc.

262 Lubricated Plug Valves — Revised Catalog PV-2, 12 pp, presents steel and semi-steel valves designed to offer quick shut-off of erosive or corrosive fluids. Explains advantages of the lubricated tapered plug design of these valves and pictures single gland, screwed gland, and bolted gland types. Also shows accessories. The William Powell Co.

263 To Get at Those Valves — This little folder describes a sprocket rim with chain guide. The rim adjusts to fit all valve wheels. Babbitt Steam Specialty Co.

264 For Precise Control — Fifty-pp Catalog 17 covers manufacturer's line of disc valves and accessories, providing full selection and ordering data, materials of construction, sizes. Describes manual and automatic controls for these valves which, it is noted, are available in any metal which can be cast or welded. Minimum pressure drop, quick closure, simplicity and other advantages are discussed. R. S. Valve Div., S. Morgan Smith Co.

265 Valve Specialties — Included in 90-pp Catalog A-50 is ordering and engineering information on automatic pressure flow and liquid level controls for steam, air, gas, water, oil, other fluids. Sections are devoted to pressure regulators, altitude valve, pump governors and strainers; lever, float and motor operated valves; pilot valves; back pressure, relief and non-return valves, steam trap and air vent; liquid level controllers; solenoid valves. Davis Regulator Co.

266 Blow-Off Valves — Bulletin B-426, 20 pp, on blow-off valves for boiler pressures up to 400 lb wsp, contains installation recommendations, construction information on Yarway seatless and double-tightening blow-off valves. Gives full ordering data, including prices. Yarnall-Waring Co.

267 Steam Trap Book — Catalog J, 44 pp, serves as a manual of trapping practice. Includes a catalog section giving physical data and prices on cast semi-steel and forged steel inverted bucket steam traps, compound steam traps and ball float air and air relief traps; a handbook section explaining how to calculate condensate loads and select traps for all classes of equipment; a maintenance section explaining trap installation, trouble-shooting and repair. Armstrong Machine Works.

268 Industrial Steam Traps — Twelve-pp Bulletin 853 describes steam traps with bellows of bronze, Monel or stainless steel, and bodies in bronze, semi-steel and cast steel construction in sizes ¼ to 2 in., for pressures from vacuum to 300 lb. Included besides capacity tables and dimensions are piping diagrams, typical applications, and data covering the selection. W. H. Nicholson & Co.

269 Piping Pointers — This company's highly popular 36-pp manual covering fundamentals of sound piping practices. Discusses various types of valve designs and how each should be used.

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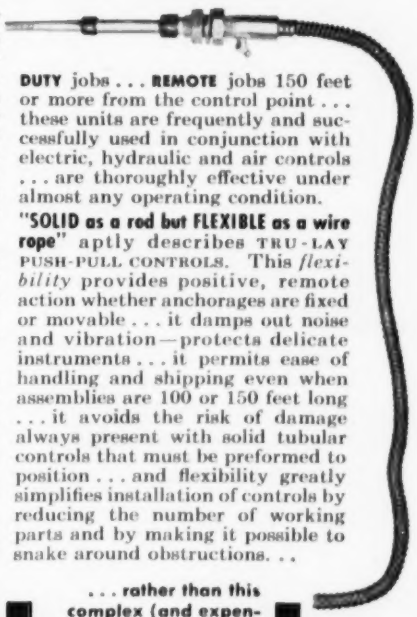

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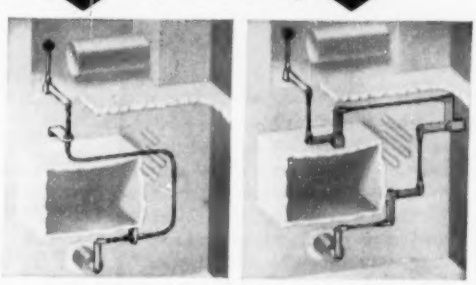

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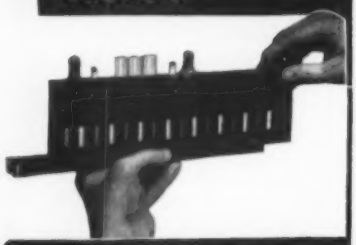

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Pictures and names more than 80 fittings and contains illustrated how-to-do-it features. Includes 8-pp valve selection guide. Crane Co.

270 Improved Pipe Hanger — Twelve-pp Bulletin 153 describes company's Counterpoise pipe hanger for high temperature piping systems in steam generating stations, refineries and chemical plants. Tells how it offers efficient load supporting effort of constant value throughout entire range of travel as pipe expands or contracts because of temperature changes. Graphs for selecting proper hangers, tables of dimensions, plus erection are given. National Valve & Mfg. Co.

271 Unions and Fittings — Twelve-pp Catalog 50 covers manufacturer's line of unions of all types, elbows, tees and fittings. It describes and illustrates special features. Dart Union Co.

272 Handbook on Fittings, Flanges — Catalog wf-1950, 68 pp, offers working information on seamless carbon steel welding fittings and forged steel flanges. Includes dimensional tolerances, thread standards and threading practice; service pressure ratings, physical and chemical requirements. Grinnell Co., Inc.

WATER CONDITIONING

273 Handbook on Demineralizing — Bulletin 5800, 39 pp, on treating water by demineralizing, explains principle of ion exchange. Discusses applications of many anion and cation exchange materials; series of curves help estimate cost of operation. Describes design and operation of demineralizer systems, multistage systems and mixed bed units. Includes curves of water quality obtainable. Cochrane Corp.

274 Modern pH and Chlorine Control — This 100-pp booklet gives details in color comparators and equipment in water testing and control of boiler and industrial process water, also technical information on meaning of pH control, electrometric and colorimetric methods of determining pH and impurities in water; applications of water control in air conditioning; feedwater. W. A. Taylor & Co.

275 Water Conditioning Data Book — This pocket-size 116-pp booklet presents 77 tables, all valuable to the power engineer. Covers such subjects as hydraulics, impurities in water, boiler feedwater make-up requirements, chemical conversions and chemical reactions. Contains excellent reference information on many phases and methods of water treatment. Available without charge to qualified power engineers. The Permutit Co.

276 What's What on Ion Exchangers — Here are three booklets on ion exchangers: Nalcite HCR, a styrene type cation exchanger; Nalcite SAR, a strongly basic anion exchanger; and Super Nalcolite, a synthetic gel type zeolite for cation exchange. Tables and graphs explain performance of these water treating resins under various operating conditions. Physical characteristics, exchange capacities, regeneration techniques discussed. Bulletin 57, 20 pp, is on Nalcite SAR; Bulletin 58, 28 pp, Nalcite HCR; Bulletin 59, Super Nalcolite. National Aluminate Corp.

277 Steam System Treatment — This bulletin on Coravol for prevention of corrosion, explains theory of corrosion, application of organic amines to steam

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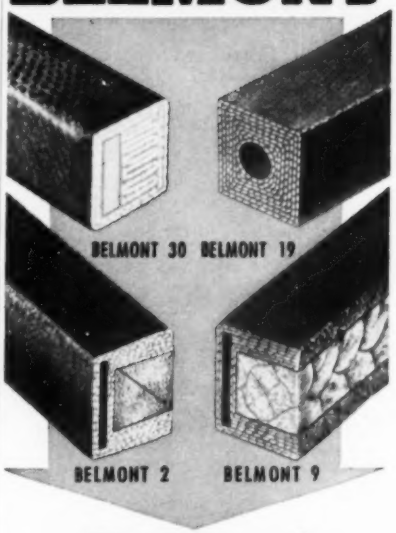

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systems (Coravol process) and presents case histories of use in different types of plants and industries. Coravol is part of a complete technical service providing chemical formulas for treatment of water, steam, brine, fuel. Western Chemical Co.

278 Water Treatment — Bulletin 5000, 24 pp, explains the reasons for boiler water treatment and tells services offered by company in providing formulations for individual plant requirements. Covers pretreatment, internal treatment, treatment application, blow-down adjustment, test control. Dearborn Chemical Co.

279 Microbiological Control — Technical Article 3C, 12 pp, is an illustrated discussion of microbiological control of and through industrial waters. A section on industrial water chlorination covers cooling waters and process waters. Other sections deal with chlorine metering in chemical processes, and the sanitary aspects of industrial water treatment. Wallace & Tiernan Co., Inc.

280 For Industrial Water Softening — Greensand, zeolite and resinous exchange water softeners are described in 8-pp Form S-105. Discusses features and applications of each of these basic types and illustrates some installations. Includes capacity data and general specifications. Also describes and pictures controls for water softeners, pressure filters and deionizers. Illinois Water Treatment Co.

A good reference file of commercial literature gives you data when you need it. Use the postage free cards on page 108 for ordering these catalogs or information on advertised products

281 Feedwater Treating — Bulletin 1855, 30 pp, features manufacturer's hot process Accelerator for treatment of boiler feedwater, illustrating and explaining its operation and advantages, also optional equipment. Contains excellent discussion of necessity for treatment of makeup water, selection of proper equipment. Also covers the limitations of hot process softening. Infilco Inc.

OTHER EQUIPMENT

282 Turbine Generators — Bulletin H-18, 40 pp, covers turbine generators of 500 kw and above, pictures nearly 50 turbine-generator installations, both utility and industrial. Brief discussions of generator and exciter cooling methods are included. A reference section offers detailed drawings. Dimensions and weights of standard units tabulated. Elliott Co.

283 Dowtherm Vaporizer — Bulletin No. 48-2, describing manufacturer's Type "A" Dowtherm Vaporizer, tells how this unit is designed to evaporate Dowtherm to provide dependable operation at maximum temperatures. The Wickes Boiler Co.

284 Packings and Gaskets — Catalog P-100C, 32 pp, covers 95 most popular packings and gaskets in company's line, furnishing details of construction, service recommendations and size information. Includes charts showing specific recommendations for many applications. Packing Div., Raybestos-Manhattan, Inc.

285 Refrigerator Condensers — Bulletin RC-2, 38 pp, utilizes drawings, tables and engineering data to show how to select proper type from company's line of ammonia and Freon condensers for refrigeration services. Illustrates horizontal multipass shell and tube types; vertical singlepass shell and tube types. Gives pipe sizes for ammonia and Freon lines; stands for large and small condensers. Henry Vogt Machine Co.

286 Specialized Scale Removal — This bulletin explains company's method of removing scale from water and gas lines with liquid cleaning solvents. Cites cleaning of oil refinery's waterlines in 38 hours with minimum service interruption, and without need of digging up buried lines. Dowell Inc.

287 Dry Ice Converters — This illustrated bulletin describes pressure vessels with removable closures into which dry ice is charged and in which the resulting carbon dioxide is stored indefinitely under pressure. Gives advantages of CO_2 for purging or use as an inert gas, and advantages of the dry ice converters as a source of CO_2. Dry Ice Converter Co.

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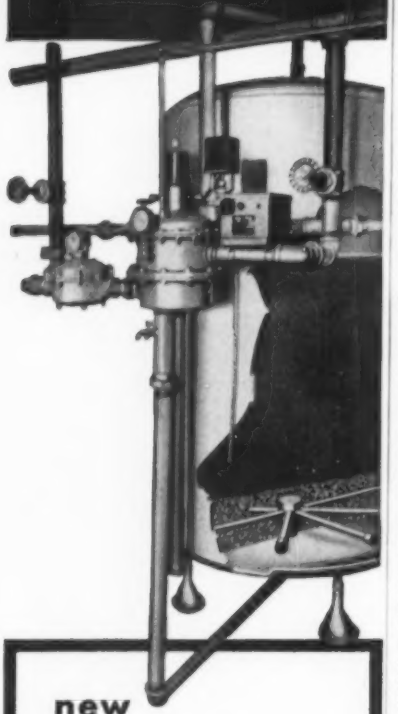

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288 Burning Bituminous Coal — This 24-pp illustrated booklet is a compilation of numerous actual case histories of industrial plants and institutions which burn bituminous coal "the modern way." Stressing operating economy achieved, these case histories show problems overcome, equipment used, and savings realized. Bituminous Coal Institute.

289 Water Heaters — Illustrated 6-pp Bulletin 70, Section I, on instantaneous type water heaters contains detailed capacity and dimension tables for two-, four- and six-pass designs, removable tube bundles. Davis Engineering Corp.

290 Seals for Bearings — Complete information on manufacturer's Klozure oil and grease seals for bearings is available in 100-pp Catalog 10. Fully illustrated in color, pictures all types of these seals, typical applications and lists sizes and part numbers. Also describes mechanical pressure seals for rotary shafts. The Garlock Packing Co.

291 To Cut Boiler Plant Costs — Savings in plant fuel and labor costs by use of continuous boiler blowoff heat recovery equipment is discussed in 8-pp Bulletin WC-114. Two pages of charts, curves and calculations show how to compute savings in Btu per year. Flow diagrams illustrate such type systems as flash and non-flash, single and double flash tank, and combination flash-deaerator. Graver Water Conditioning Co.

292 Communication Systems — Sixteen-pp Form P831 presents communication systems engineered for power plants. Advantages of such a system are given and photos show it in use in turbine rooms, boiler rooms, control rooms, laboratories and outdoors. Amplifiers, handsets, speakers, wall baffles, signal lights, switches and master control equipment incorporated are covered. RCA Victor Div., Radio Corp. of America.

293 Heat Exchanger — Bulletin 114, a small folder, gives concise information on company's Aero heat exchanger with balanced wet bulb control designed to cool engines or process equipment, coolants and lubricants, liquids and gases for processing operations. Niagara Blower Co.

294 Preheating Combustion Air — This well-illustrated 36-pp booklet explains fuel savings and increased performance made possible by using waste heat in flue gases to preheat incoming combustion air. Also covers increased boiler output, ability to use lower grade fuels, other advantages afforded. Booklet contrasts regenerative with recuperative preheaters; explains operating principle and structural details of the Ljungstrom air preheater. Industrial applications for other than power boilers are covered and layout drawings of typical preheater arrangements given. Air Preheater Corp.

295 Industrial Products Guide — Newest edition of this company's industrial products catalog is a 40-pp book offering essential data on insulations, refractory products, asbestos cement pipe, packings, gaskets, electrical products, frictional materials, and others. Photos, diagrams, and text have been brought up to date. Johns-Manville.

296 Automatic Soot Blowing — Bulletin 483 provides 16 pp of basic information about Vulcan automatic and automatic-sequential soot blowing. Includes a wide variety of typical installation drawings to show complete cleaning systems. Copes-Vulcan Div., Continental Foundry & Machine Co.

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297 Sheet and Plate Fabrication — Illustrated in 40-pp Bulletin F-3 are products of this manufacturer, and equipment used to produce special sheet steel and alloy parts. Shows control panels, switch gear housings, cubicles and other electrical enclosures, boiler air ducts, smoke breechings, tanks. The Kirk & Blum Mfg. Co.

298 Industrial Equipment — Bulletin WP-1099-B61, 16 pp, describes manufacturer's industrial equipment including centrifugal refrigeration, condensers and coolers, steam power plant equipment, water conditioning deaerators and rotary pumps. Worthington Corp.

299 Refractories for Heat, Power — Compiled to help power engineers solve refractory problems and get greater operating efficiency from their boilers, this booklet provides 32 pp of practical information on company's Crystolon refractories. Properties and characteristics of these silicon carbide products are given and separate chapters cover those for air-cooled, solid wall and water tube protection, and for repairs. Norton Co.

300 Refractory Concrete — This 28-pp booklet describes company's Lumnite, a calcium aluminate cement for refractory concrete. Discusses characteristics of Lumnite, methods of making refractory concrete. Chapters are devoted to summary of aggregates and proportions; heat-resistant concrete; refractory insulating

concrete; insulating over-coats for industrial furnaces; castable refractories. Universal Atlas Cement Co.

301 **Ejector Instruction Manual** — Bulletin J-50-7 is a 36-pp handbook covering operation, selection, installation and maintenance of steam jet air ejectors. Discusses twin and triple element ejectors, surface and jet inter- and after-condensers, isolating valves, drain traps, steam and back pressures. Foster Wheeler Corp.

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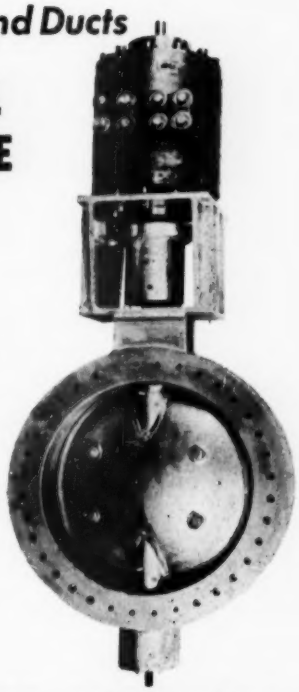

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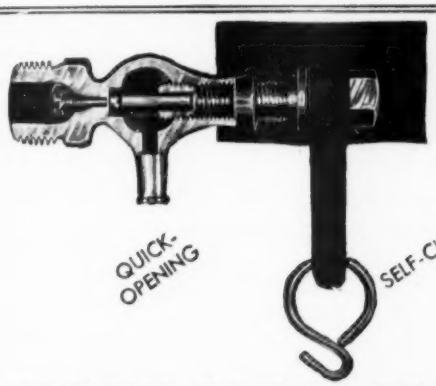

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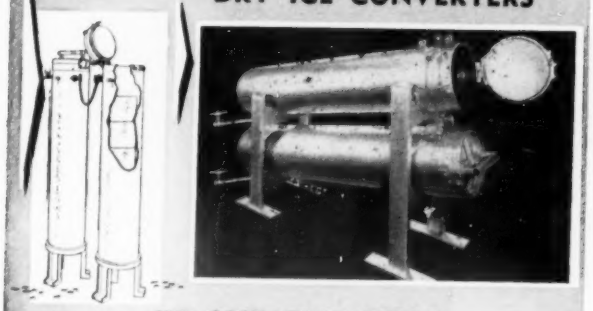

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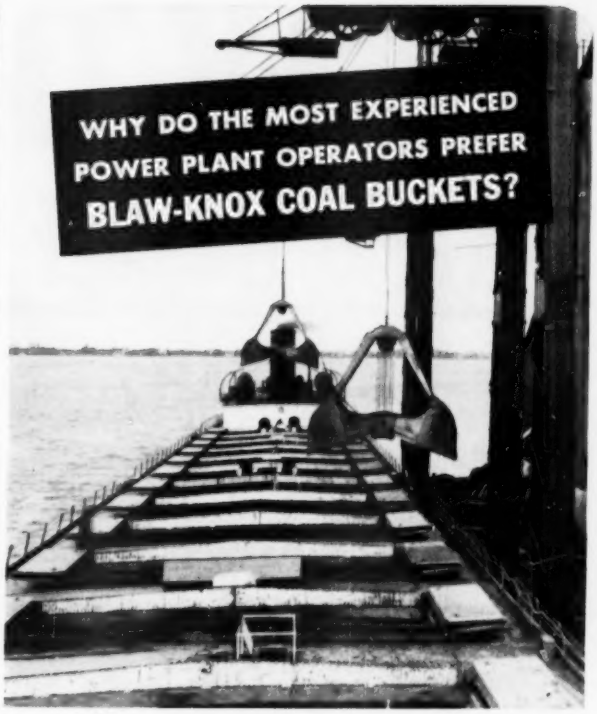

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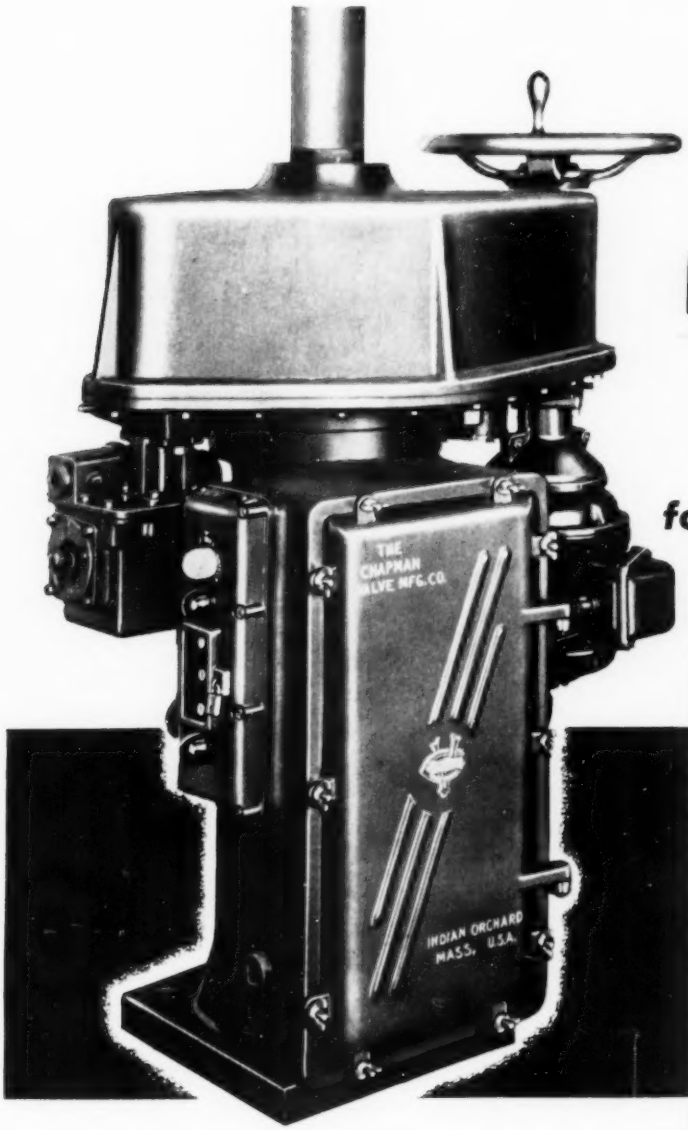
for Valves, Floorstands and Sluice Gates



Floorstand equipped with Motor Unit . . . control panel, motor, limit switch and push button station.

Simple, durable mechanism of Chapman's Motor Unit. Handwheel remains stationary during motor operation.

Chapman Motor Units have fewer components than any other units, providing greater dependability, much lower maintenance costs.

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The CHAPMAN Valve Manufacturing Company

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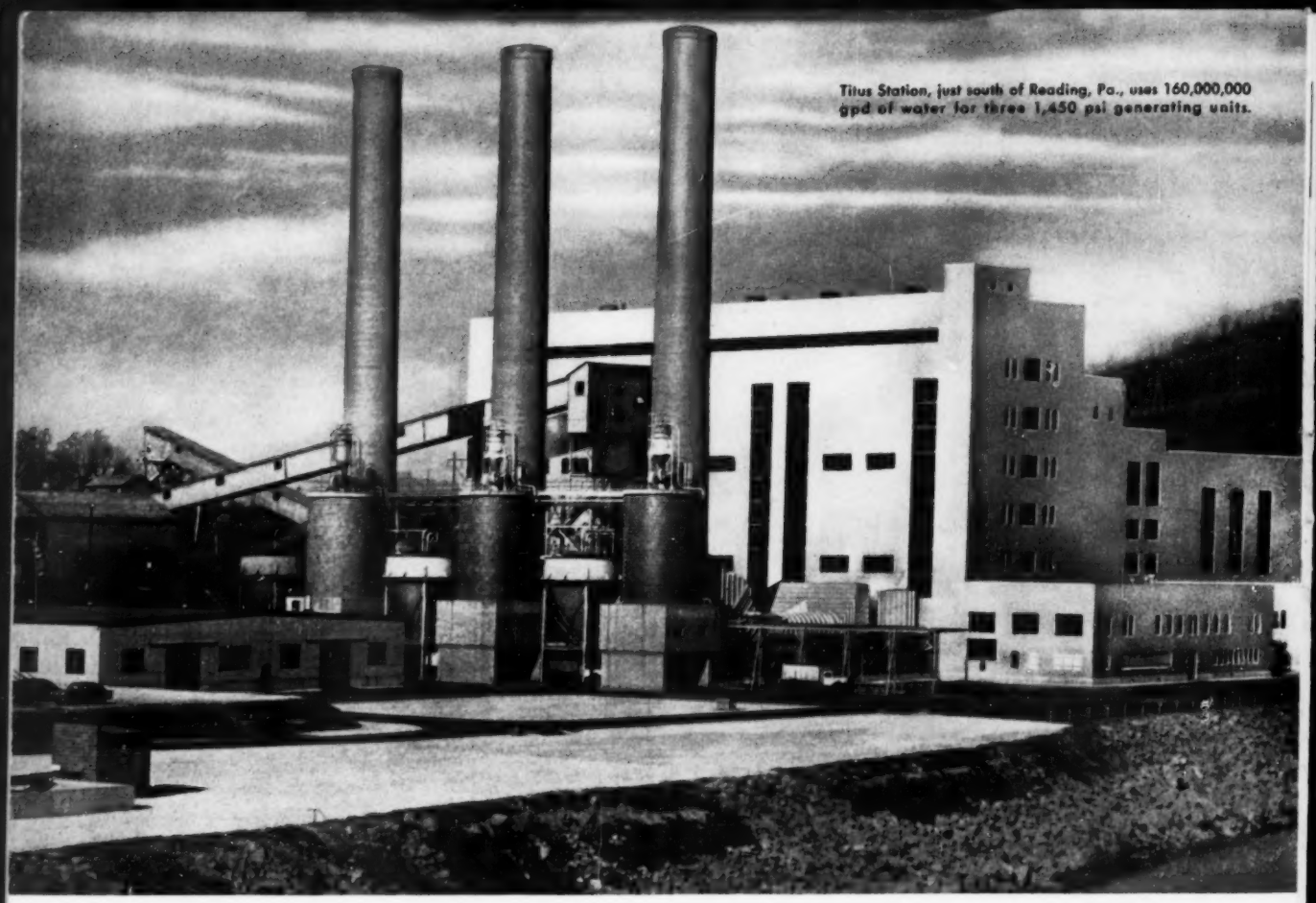

Titus Station, just south of Reading, Pa., uses 160,000,000 gpd of water for three 1,450 psi generating units.

METROPOLITAN EDISON BOOSTS CAPACITY BY 240,000 KW!

Latest $35,000,000 investment is protected by Permutit-conditioned water

Sheathed in aluminum—this silver giant is the last word in reliability and design.

Titus Station's output almost equals that of 5 other Metropolitan Edison Company stations. Permutit was selected to protect this important plant from untreated Schuylkill River water . . . turbidity of 700 ppm, hardness up to 180 ppm, high iron and manganese.

Two Permutit Precipitators remove trouble-making suspended solids, give clarified water for bearing cooling, oil coolers, etc. Part of this water goes on to Permutit filters and softeners . . . comes out crystal clear and completely softened for more critical uses.

You can get this same protection for your plant. We will be glad to supply helpful information on your particular water problems. Write today.

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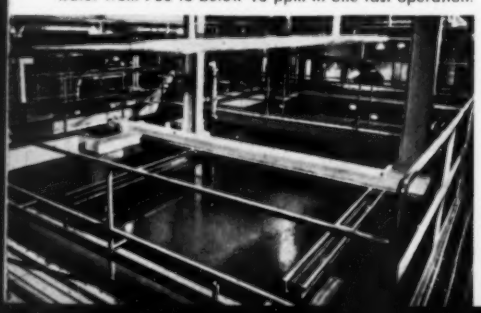
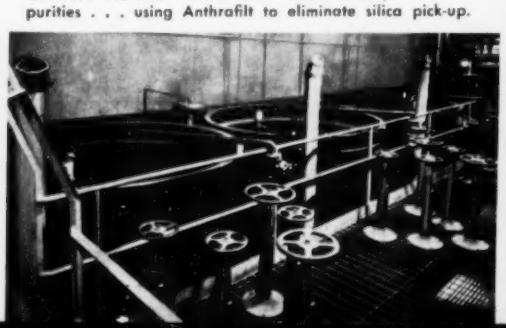
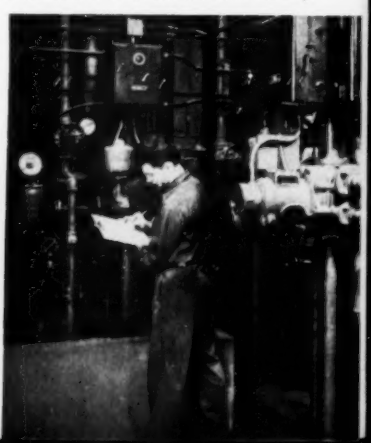
Water Conditioning Headquarters for Over 40 Years

PRECIPITATORS reduce turbidity of Schuylkill River water from 700 to below 10 ppm in one fast operation.



GRAVITY FILTERS remove final traces of suspended impurities . . . using Anthrafilt to eliminate silica pick-up.



AUTOMATIC SOFTENERS deliver *completely softened water.* Regeneration is automatic . . . saves time and money.